DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH

B.Sc. (HONS.), I-Semester
INDUSTRIAL CHEMISTRY
Industrial Aspects of Organic and Inorganic Chemistry (ICB-151)

Credits: 4
4Period/week
M.M.: 100 (30+70)

A: Industrial aspects of Organic Chemistry

Unit – I
(a)   Nomenclature: - Generic Name, Trade names
(b)   Raw materials for organic compound: Petroleum Natural gas, Fractional of crude oil, cracking, reform, hydroforming, isomerisation.

Unit – II
(a)   Coal : Types, structures, properties, distillation of coal, chemicals derived from them
(b)   Renewable natural resources: Cellulose, Strach - Properties, modification, important, ind. chemical derived from them, Alcohol and alcohol based chemicals, oxalic acid, furfural.

B : Industrial Aspects of Inorganic Chemistry
Unit – III
(a)   Basic Metallurgical operations : Pulverisation, Calcination, Roasting, Refining.
(b)   Physicochemical Principles of extraction of : Iron, Copper, Lead, Silver, Sodium, Aluminium, Magnesium, Zinc, Chromium.

Unit – IV
(c)   Inorganic materials of industrial importance : Their availability, forms structure and modification, Alumina, silica, silicates, clays, mica, carbon, zeolites.

Books:
   1. Industrial Organic Chemicals, by Harold A. Wittcoff, Bryan G.Reuben.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), I-Semester
INDUSTRIAL CHEMISTRY
Descriptive Statistics (IFB 151)

Credits: 4
4 Period/week
M.M.: 100 (30+70)

UNIT I: Graphical Representation of Data

Classification, bar diagram, pie diagram, histogram, frequency polygon and curve, cumulative frequency curve

UNIT II: Measures of Central Tendency and Dispersion

Mean, median, mode, geometric mean, harmonic mean, mean of combined series, range, quartile deviation, absolute mean deviation, standard deviation, variance, coefficient of dispersion, coefficient of variation, combined variance, skewness, kurtosis

UNIT III: Correlation

Bivariate data, scatter diagram, coefficient of correlation, properties of correlation coefficient, rank correlation, repeated (tied) ranks, probable and standard error of correlation coefficient

UNIT IV: Regression Analysis

Linear regression, least square method of fitting of regression line, plotting of regression line, regression coefficient, fitting of non-linear curves

SUGGESTED READINGS:

• **Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics. Sultan Chand &** Sons, New Delhi.
• **Goon, A.M., Gupta, M.K. and Dasgupta, B.: Fundamentals of Statistics, Volume I. The** World Press, Calcutta.
• **Elhance, D.N.: Fundamentals** of Statistics. Kitab Mahal.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), I-Semester
INDUSTRIAL CHEMISTRY
Linear Algebra and Complex Analysis -I (IFB-152)

Credits: 2
2 Period/week
M.M.: 100 (30+70)

UNIT I: **Linear and Quadratic Equations**

Polynomials, solution of simultaneous linear equations in two variables (method of elimination and cross multiplication), roots of quadratic equations, solution of general quadratic equations (method of factorization, completing squares and use of discriminant function), solution of equations reducible to quadratic forms

UNIT II: **Complex Numbers**

Complex numbers (equality, addition, subtraction, multiplication and division),

conjugate, modulus and argument of a complex number, geometrical and vectorial representation of a complex number, cube root of unity, De-**Moivre's** theorem

SUGGESTED READINGS:

• **Sharma, R.D.: Mathematics, Class XI. Dhanpat Rai Publications, New Delhi.**

• **S**harma, R.D.:Mathematics, Class XII, Volume 1. Dhanpat Rai Publications, New Delhi.

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), II-Semester
Elements of Probability Theory and Testing of Hypothesis (IFB 251)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

UNIT I: **Probability Theory - I**

Deterministic and non-deterministic experiments, sample space, events and trails, mutually exclusive, exhaustive and equally likely events, mathematical, statistical and axiomatic definition of probability, addition and multiplication theorem

UNIT II: **Probability Theory - II**

Independence of events, conditional probability, Bayes theorem, numerical problem

UNIT III: **Discrete and Continuous Distributions**

Discrete and continuous variables, probability mass function, probability density function, distribution function, binomial and Poisson distributions and their recurrence relations, normal distribution, chief features of normal curve

UNIT IV: **Test of Significance**

Statistical hypothesis, null and alternative hypotheses, types of errors, level of significance, procedure for testing of statistical hypothesis, tests based on normal, chi-square and t distributions

Reference Books / Suggested Readings:

1. Gupta, S.C. and Kapoor, V.K.:   Fundamentals of Mathematical Statistics. Sultan Chand & Sons, New Delhi.

2. Goon, A.M., Gupta, M.K. and Dasgupta, B.:   Fundamentals of Statistics, Volume I. The World Press, Calcutta.

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), II-Semester
Linear Algebra II (IFB 252)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

UNIT I: Matrices

Types of matrices, equality of matrices, matrix addition and scalar multiplication, matrix multiplication, transpose and adjoint of a matrix, inverse of a matrix, solution of simultaneous linear equations by matrix inversion method, elementary transformations, solution of linear equations by Gauss-Jordan elimination method

UNIT II: Determinants

Formation of determinants, difference between matrix and determinant, minors and cofactors of the elements of a determinant, properties of elementary transformation of a determinant, Crammer's rule, application of determinants in solutions of equations

Reference Books / Suggested Readings:

1. Sharma, R.D.:   Mathematics, Class XI. Dhanpat Rai Publications, New Delhi.

2. Sharma, R.D.:   Mathematics, Class XII, Volume 1. Dhanpat Rai Publications, New Delhi.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) III Semester
Industrial Chemistry
Processes in Organic Chemicals Manufacture (ICB-351)

Credits: 4
M.M : 100 (30+70)
4 Periods/week

Unit 1(a)   Nitration : Introduction - Nitrating agents, kinetics and mechanism of nitration process such as nitration :
   i) Praffinic hydrocarbons
   ii) Benzene to nitrobenzene and m-dinitrobenzene
   iii) Chlorobenzene to 0- and p-nitrochlorobenzenes
   iv) Toluene.
       Continuous vs batch nitration.

Unit 2 (b)   Halogenation : Introduction - kinetics of halogenation of reactions, Reagents for halogenation, halogenation of aromatics - side chain and nuclear halogenations, Commercial manufactures - chlorobenzenes, chloral, monochloracetic and chloromethanes, dichloro fluoromethane.

Sulphonation - Interaction - sulphonating agents, Chemical and physical factors on sulphonation kinetics and mechanism of sulphonation reactions, Commercial sulphonation of benzene, naphthalene, alkyl benzene, batch vs continuous sulphonation.

Unit 3   Oxidation : Introduction - Types of oxidation reactions, Oxidizing agents, kinetics and mechanism of oxidation of organic compounds, liquid phase oxidation, vapor phase oxidation, commercial manufacture of benzoic and maleic anhydride, phthalic anhydride, acrolein, acetaldehyde, acetic acid.

Hydrogenation: Introduction - Kinetics and thermodynamics of hydrogenation reactions, Catalysts for hydrogenation reactions, Hydrogenation, of vegetable oil, manufacture of methanol from carbon monoxide and hydrogen, hydrogenation of acids and esters in alcohols, catalytic regorming.

Unit 4   Alkylation: Introduction, Types of alkylation, Alkylating agents, thermodynamics and mechanism of alkylation reactions, manufacture of alcohol, N-alkyl anilines (mono dimethyl and ethyl anilines.).

Esterfication: Introduction, Hydrodynamics and kinetics of esterification reactions, Esterfication by organic acids, by addition of unsaturated compounds, esterification of carboxyl acid derivatives, commercial manufacture of ethyl acetate, dioctle phthalate, vinyl acetate, cellulose acetate.

Amination: A by reduction: Introduciton, Methods of reduction-metal and acid, catalytic sulfide, electrolytic caustic oxidation, reduction, commercial manufacture of aniline, m-nitroaniline, p-amino phenol.

By aminolysis : Introduction, aminating agents, factors affecting

Hydrolysis : Introduction; hydrolysis agents, kinetics, thermodynamics and mechanism of hydrolysis.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), IV-Semester
INDUSTRIAL CHEMISTRY
Calculus (IFB 351)

Credits: 4
4 Period/week
M.M.: 100 (30+70)

UNIT I: Function and Limits

Concept of real function, its domain and range, polynomial, exponential, logarithmic, modulus functions and their graphs. Limit of a function, informal and formal approach to limit, evaluation of left and right hand limits, algebra of limits, related theorems on limit (without proof)

UNIT II: Continuity and Differentiability

Continuity of a function at a point, continuity on an open and closed interval, algebra and properties of continuous function, discontinuous function, differentiability at a point, relation between differentiability and continuity.

UNIT III: Differentiation

Differentiation using first principle, differentiation of implicit functions, logarithmic and parametric differentiation, chain rule, differentiation of a function with respect to another function, higher order derivatives.

UNIT IV: Indefinite Integrals

Indefinite integral and its properties, fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions, integration by substitution and by parts, integration of rational functions, integration involving partial fractions

SUGGESTED READINGS:

• **Sharma, R.D.: Mathematics, Class XI. Dhanpat Rai Publications, New Delhi.**

• **Sharma, R.D.: Mathematics, Class XII, Volume 1. Dhanpat Rai Publications, New Delhi.**

• **Gorakh Prasad: Differential Calculus.** Pothisala Pvt. Ltd.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), III-Semester
INDUSTRIAL CHEMISTRY
Statistical Methods (IFB-352)

Credits: 2
2 Period/week
M.M.: 100 (30+70)

UNIT I: Sample Survey and Sampling Methods

Basic concept of sampling, definition of random sampling, advantages of sampling over census, procedure of selection of a simple random sample, estimate of population means and its variance in simple random sampling, stratified sampling

UNIT II: Index Numbers and Time Series

Definition, uses and limitation of index numbers, characteristic and classification of index number, criteria of good index number, problem in the construction of index number, method of computation of index numbers, chain based index number, consumer price index number, concept of ideal index number, tests of index numbers. Definition and utility of time series, components of a time series, additive and multiplicative models, measurements of trend, measurement of seasonal variations

SUGGESTED READINGS:

• Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics. Sultan Chand & Sons, New Delhi.
• Goon, A.M., Gupta, M.K. and Dasgupta, B.: Fundamentals of Statistics, Volume II. The Word Press, Calcutta.
• Elhance, D.N.: Fundamentals of Statistics. Kitab Mahal.

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH

B.Sc. (HONS.) IV Semester
Industrial Analytical Chemistry (ICB-451)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

Part A: Analytical Techniques

Unit-I **(A)** Classification of Analytical methods; Types of instrumental methods, Instruments for Analysis, selecting an Analytical method, Factors affecting Analytical methods, calibration of instrumental methods

(B) Application of operational amplifiers; voltage and current control, to mathematical operations.

(C) Limitations of Analytical methods, classification of errors, Accuracy and precision, mean and standard deviation, Distribution of random errors, confidence intervals, comparison of results, paired t-test, the number of replicate determinations, correlations and regressions, Yates methods, Data handling, Factors Analysis.

(D) Sampling techniques gases and vapors, liquids and solids.

Unit-II **(A)** Separation techniques: solvent extraction, Ion-exchange separations, Instrumental separations.

(B) Chromatography: TLC, LC, GC, HPLC methodology, equipment and Industrial Applications.

(C) Titrimetric Analysis: Classification of reactions, principles of potentiometric titrations.

(D) Mechanical-physical separation process: introduction, classification and Filtration in solid-liquid seprations.

Part B**: Pollution**

UNIT III

I (a): Introduction to Pollution
Significant of dissolved oxygen and its estimation,
Bio – accumulation, Bio magnification and Eutrophylication of pollutants
Pollutants and their types.
Chemical oxygen demand and biological oxygen demand.

I (b): Air pollution and air quality monitoring, water pollution and water quality monitoring, Soil/Land pollution and soil quality monitoring.
Thermal Pollution
Noise Pollution
Formation and break down of ozone in the atmosphere, ozone depletion
Green house effect.

UNIT IV

II (a): Pollution aspects of cement industry.
Pollution aspects of paper & Pulp Industry.
Pollution aspects of thermal power plant
Management and disposal of various types of waste.

II (b): Bhopal gas disaster.
Sevazo disaster.
Minimata disaster.
Better Industrial Process.

Reference Books / Suggested Readings:
1. Environment – Problems & solution by. D.K.Asthana & Meena Asthana
2. Environmental Pollution by R.K khitoliya
3. Environmental Chemistry by A.K Dey
4. Environmental Pollution – Monitoring & Control by Khopar S.M

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), IV-Semester
CHEMOMETRICS (IFB 451)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

Unit-I   Statistical Analysis of Laboratory Data:

Introduction, Measurements, Accuracy and Precision, Mean, Standard deviation. What is and why you should be worried, Pooling standards for fun and profit, Decisions based on the Gaussian Distribution, Confidence intervals, Statistical samples and how many measurements to take.

Unit-II   Statistical Inference:

Standard deviation and their statistical distribution, Statistical hypothesis testing, p-values, Student's t and confidence intervals for the mean, One sample t-test for the equivalence of a mean, One sample t-test for the equivalence of two means, Paired t-test, F-test for the equivalence of two variances, One-way analysis of Variance (ANOVA), Detecting outliers.

Unit-III Modelling & Regression Analysis:

Linear Models Terminology and Symbology, Choice of models and least squares fitting of models to data , Estimated responses and residuals, Replication, purely experimental uncertainty and lack of fit, , Correlation coefficient and other diagnostics, F-test for significance of regression and lack of fit, Confidence bands, importance of placement of experiments, Importance of precision in measurements processes,

Unit-IV Designs and Analysis of Experiment.

Multi-factor experimental design, Randomization and interaction, Factorial designs, Fractional factorial designs and confounding, Blocking, Screening experiments: Plackett-Burman designs, saturated fractional factorial designs, Response surface modeling: Central composite designs, Box-Behnken designs, Taguchi concepts, Application of experimental design to chemical laboratory and industrial R&D problems.

Reference Books / Suggested Readings:

1. Introduction to Multivariate Statistical Analysis in Chemometrics by Kurt Varmuza, Peter Filzmoser, February 17, 2009 by CRC Press
2. Chemometric Techniques for Quantitative Analysis by Richard Kramer 215 pages, Marcel-Dekker (1998)
3. Data Analysis for the Laboratory and Chemical Plant by Richard Breret

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.), IV-Semester
Numerical Methods (IFB-452)

Credits: 2
M. M.: 100 (30+70)
2 Periods/week

UNIT I: Ordinary Differential Equations and partial Differential Equations:

Basic definition, solution of first order differential equation by separating variables, homogeneous and linear differential equations of first order, elementary ordinary differential equation of second order and their solutions. Function of several variables, partial differential and related results, homogeneous function, Euler's theorem, elementary partial differential equation, their classification and methods for solving such partial differential equations.

UNIT II: Numerical Analysis:

General iteration method, Newton-Raphson method, application of Newton-Raphson method, solution of system of linear equations by Gauss elimination method and Gauss Siedel method.

Reference Books / Suggested Readings:

1. Sastry, S.S.:   Introductory Methods of Numerical Analysis. Prentice Hall of India Pvt Ltd.
2. Zafar Ahsan: Differential Equations and their Applications. Eastern Economy Edition.
3. Sharma, R.D.:   Mathematics, Class XII, Volume 1. Dhanpat Rai Publications, New Delhi.
4. Sharma, R.D.:   Mathematics, Class XII, Volume 2. Dhanpat Rai Publications, New Delhi

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) V Semester
Industrial Chemistry
Industrial Waste Treatment & Management (ICB-551)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

Unit I
Industrial Waste Water Treatment Technology, types of treatment physical, chemical and biological. Treatment levels Primary (Sedimentation, Filtration, Grit removal etc), Secondary (Trickling filter, rotary drum reactor, aerobic and anaerobic treatment), Tertiary Treatment (Adsorption, advanced oxidation etc). Strategies for Industrial water recycle and reuse.

Unit II
Solid Waste Management
Types of waste, management of solid waste, treatment and disposal of non-hazardous solid waste (landfills, scrubbing, flue gas cleaning, incineration, heat drying, wet oxidation, biodegradation etc), treatment of hazardous waste, E-waste treatment.

Unit III
Biosorption of Metals
Introduction, heavy metals, Biosorption by fungi, algae and bacteria, factors affecting biosorption, bioreactors for Biosorption- Packed bed reactor, fluidized bed reactor, rotating disc reactor, sequential reactor.

Unit IV Biotechnological Intervention in Environmental Management
Biotechnological application to the management of environment- Composting, Carbon Sequestration, Bioenergy and biofuels, Anaerobic digestion for methane production, factors affecting biogas production.

Books Recommended:
1. Environmental Chemistry by AK De
2. Environmental Biotechnology by Indu Shekhar Thakur
3. Bioconversion of waste to industrial products, Editors: A. M. Martin ISBN: 978-1-4613-7668-2 (Print) 978-1-4615-5821-7

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) V Semester
Industrial Chemistry
Industrial Pharmaceuticals (ICB - 552)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

UNITS – I

1.1 Pharmaceuticals Chemistry – Introduction – nature and sources of drugs –Study of drugs- classification and nomenclature of drugs- Mechanism of drug action and metabolism of drugs.

1.2 Clinical Chemistry _ determination of sugar in serum- estmation of glucose in urine- detection of cholesterol in urine – detection of dibetes- estimation of hemoglobin- red cell count.

UNIT –II

2.1 Causes of common diseases and their treatment by drugs Insect borne, air- borne and water borne diseases- disorder of digestive system- diseases of respiratory system- disorder of nervous system.

2.2 Medicinally important inorganic compounds- compounds of aluminium,phosphorous,arsenic, iron and mercury- biological role of inorganic compound – role of sodium, potassium, calcium, iodine, copper and their compounds.

UNITS –III

3.1 Sulphonamides – Introduction- mechanism of action of sulpha drugs – Cancer – introduction of ancer – common causes of cancer – spread of cancer – treatment of cancer.

3.2 Diabetes and Hypoglycemic drugs- Introduction to diabetes – control of diabetes- chemical structure of insulin – oral hypoglycaemic agents- Sulphonyl urea and biquanides.

UNITS –IV

1.3 Anesthtics – general anaesthics only – Analgesics, Anti pretics and Anti Inflammatory agents – anagestic action of morphine – synthetic analgesis.

1.4 First aid: Treatment of shock – hemorrhage, cuts and wounds, burns- Classification and first aid.

Books Suggested:
1. Wilson and Gisvolds Text Book of Organic Medicinal and Pharmaceutical Chemistry, 8th Edn. Edited by R.F. Doerge. J.B. Lippinott Company, Philaderphia, 1982.
2. W.O. Foye, T.L. Lamke, D.A. Williams, Principles of Medicinal Chemistry 5th Edn. Lippencott Williams and Wilkins, 2002.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) V Semester
Elementary Spectroscopy (ICB - 553)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

UNITS -I
1.1 **Data Analysis** – Theory of error - Idea of significant figure and its importance with examples – Precision – accuracy – method of expressing accuracy – error analysis – minimizing error method of expressing precision- average deviation – standard deviation and confidence limit.

1.2 **Mass Spectrscopy:** basic principal of mass spectrum- molecular peak – base peak- isotopic peak-meta stable peak – factors influencing the fragmentation – nitrogen rule - ring rule determination of molecular formulate with examples – instrumention.

UNITS- II

2.1 **Infra red spectroscopy :** molecular vibration- **Hooke's law** –vibration frequencies – factors affecting vibration frequencies- instrumentation – block diagram- source – monochormator – cell sampling echiques- detector recorders- solvent shift.

2.2 **Raman Spectroscopy:** Rayleigh and Raman Scattering- strokes and Anti Stokes lines- instrumentation- block diagram- differences between IR and Raman spectroscopy- mutual exclusion principle – applications.

UNITS- III

NMR spectroscopy : Principle of nuclear magnetic Resonance- basic instrumentation- shielding mechanism – chemical shift- number of signals-spin- spin coupling and coupling constant – splitting of signals.

NMR spectrum of simple organic compound such as ethyl bromide, 1, 1,2- tribromoethane, ethanol, acetaldehyde,

UNITS- IV
4.1 **UV- Visible spectroscopy** – Absorption laws, calculation involving beer

Lamberts Law- Instrumentation photo colorimeter and spectrophotometer – block diagram with description of components- theory- types of electronic transition- chromophore and auxochromes- Absorption bands and intencity – factor governing absorption maximum intensity.

Books Suggested:
1. Principles of Instrumental Analysis, D.A. Skoog, F.J. Holder, T.A. Nieman, 5th Edn. Thomson, Brooks/Cole, 1998.

2. Instrumental Analysis, H.H. Willard, L.L. Merritt, Jr. J.A. Dean, F.A. Seatle, Jr. 7th Edn. 1986.

DEPARTMENT OF CHEMISTRY
A.M.U. ALIGARH
B.Sc.(HONS.) INDUSTRIAL CHEMISTRY
V Semester
Computers for Industries   (ICB-554)

Credits: 2
M. M.: 100 (30+70)
2 Periods/week

Unit-I   Introduction to computers
 a) Organization of simple computers
 b) Hardware,software,types of computers
 c) Secondary storage
 d) Introduction to operating system viz;DOS,UNIX and WINDOWS.
 e) Data processing
 f) Languages
 g) Flow-charts
 h) Algorithms
 i) Binary & hexa decimal
 j) Computer viruses

 Unit-II (a)   Numerical Methods of analysis
 a) Types of matrices (identity, transpose, inverse, determinant)
 b) Matrix Manipulation (addition, subtraction, multiplication, inversion, determinant of matrix)
 c) Solutions of simultaneous Equations
 d) Solution of non-linear equations-Iterative method, Successive Bisection method and Newton Raphson method
 e) Regression Analysis-Least squares method, linear Regression of data
 f) Numerical Integration-Integration techniques, Trapezoidal and Simpson's rule for numerical integration.

Unit-II(b)   Introduction to Ms Office (Word,Excel,Power point, Access)

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH

B.Sc. (HONS.) V Semester
Industrial Chemistry
Practical (Waste Mangement CVB-5P1)

Credits: 2
03Periods/ Week
M. M.: 100 (30+70)

1. To determine phenolphthalein alkalinity methyl alkalinity and total alkalinity in given sample.
2. To determine total hardness & calcium hardness in the given of water. Express your result in moles/litre and mg/l as $CaCO_3$.
3. To determine acidity in the given sample of water. Express your result in equivallance/L and mg/L as CO_2
4. To determine the percentage of available chorine in the given chlorine solution sample.
5. To determine the chloride content in a given sample of water.
6. To determine the dissolved oxygen in the given sample of water.
7. To determine the 3 day BOD of the given sample of water.
8. To determine COD of the given waste water sample.
9. To determine total solids (T.S) and total dissolved solids (T.D.S) in the given sample of water.
10. To determine pH of the given different sample of water.
11. To determine the conductivity of the sample of water.
12. To find out the potassium in given sample of water.
13. To find out particular matter in the air.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH

B.Sc. (HONS.) V Semester
Industrial Chemistry
Practical (Pharmaceuticals – CVB-5P2)

Credits: 2
03Periods/ Week
M. M.: 100 (30+70)

Pharmaceuticals

1. To determine the refractive index of given liquid.
2. To determine the acid value of a given substance.
3. To determine the saponificaiton value of given substance.
4. Thin Layer Chromatography.
5. To determine the loss in weight on drying of drugs.
6. To determine the percentage of sulfated ash in crude drug.
7. To determine the successive extractive value of the crude drug.
8. To determine the Cl-value in crude drug.
9. To determine the the Iodine value.
10. To estimate Tannins in crude drug.

DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH

B.Sc. (HONS.) V Semester
Industrial Chemistry
(Instrumentation Methods of Analysis) (5P3)

Credits: 2
03Periods/ Week
M. M.: 100 (30+70)

Instrumentation Methods of Analysis

1. To determine the wave length of maximum absorption (λ_{max}) and to verify the Bear-**Lambert's law and to determine the concentration** of cobalt nitrate solution by spectrometry.

2. Determination of Iron by spectrometry with the help of potassium thiocynate as a complexing agent.

3. To determine the milli equivalent of SO_4 ions present in the given amount offerrous ammonium sulphate by ion-exchange method.

4. Separation of iron-cobalt ion-exchange chromatography.

5. Determination of sodium in a sample of sodium chloride solution with the help of flame photometers.

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) VI Semester
Agrichemicals (ICB-651)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

Unit-I:

(a).   **Introduction:** General introduction to Agrichemicals. Introduction and types of pesticides. Stomach   poisons, contact poisons, systemic poisons, fumigants.

(b).   **Insecticides:** Synthesis and manufacture, mode of action and uses of insecticides in the following classes: Inorganic insecticides (acid lead arsenate and calcium arsenate), Natural organic insecticides (nicotinoids, nicotine, nornicotine, and rotenoids), Synthetic insecticides (DDT, dimite, BHC, Chlordan, aldrin and dieldrin) and Organophosphorus insecticides (dimecron, methyl parathion, malathion, carbaryl and baygon).

Unit-II: Fungicides

General introduction and classification of fungicides. Synthesis and manufacture, mode of action and uses of: Inorganic fungicides (copper sulphate and bordeaux mixture), Organomercuric compounds (ethylmercuric chloride and ceresan-M), Dithiocarbamates (zineb and maneb) and Miscellaneous fungicides (captan and folpet).

Unit III: Herbicides, Fumigants, Nematicides, Rodenticides and Plant growth regulators

General introduction. Synthesis and uses of the following: Herbicides (2,4-D and MCP), Fumigants (ethylene halides and methyl halides), Nematicides (aldicarb and fensulfothion), Rodenticides (zinc phospide and warfarin) and Plant growth regulators (gibberellic acid and **Fertilizers** indole acetic).

Unit IV:

General introduction of fertilizers. Nitrogenous fertilizers, Phosphatic fertilizers, Superphosphate of lime, triple superphosphate and NPK fertilizers. Manufacture, properties and fates of the following fertilizers: Urea, Calcium ammonium nitrate, Ammonium phosphate, Potassium metaphosphate, Super phosphate and Potash (nitrate and sulphate).

Reference Books / Suggested Readings:

1. Chemistry of pesticides by N. K. Roy.
2. Fertilizers: A textbook by Ranjan Kr. Basak.

INDUSTRIAL CHEMSITRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) VI Semester
Polymer Science (ICB-652)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

Unit-I   **Introduction** :
Brief history of macromlecular science, general characteristics of polymers in comparison to common organic compounds, some basic definitions (flunctionality, polymer, polymerization, homopolymer, copolymer terpolymer etc.).
Classification of polymers :
Natural synthetic, inorganic, organic, thermoplastics, thermosets, glasses, elastomers, fibres, commodity engineering, speciality, linear, branched, cross-linked copolymers (random, alternative, block and graft), tacticity (isotactic, and atactic polymers), crystallinity (crystalline, semi-crystalline and amorphous polymers.

Unit-II   **Types of polymerization** :
Addition polymerization (mechanism of free-radical, anionic and cationic polymerization), initiators, inhibitors, retarders, living polymers, condensation polymerization copolymerization, coordination polymerization (bulk, suspension, emulsion, solution).
Molecular weight and molecular weight distribution :
Average molecular weight, number - average and weight-average molecular weights, sedimentation and viscosity average, molecular weights, practical significance of molecular weight and molecular weight distribution, size of polymer molecules, determination, of molecular weight (viscosity, osmometry, light scattering).

Unit-III   **Polymer properties :**
Glassy state and glass transitio temperature, factors influencing Tg, Tg and Tm, Importance of Tg, amorphous state, viscoelasticity and five regions of viscoelastic behaviour of polymers, rubber elasitcity, mechanical properties of polymers, polymer degradation Thermal, oxidative, photo-degradation), polymer stabilization.

Polymer processing :
Compounding, vulcanization reinforcement, calendering, die-casting, filmcasting, compression moulding, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, melt spinning.

Unit-IV   **Polymer structure-property relationship :**
General considerations, control of Tm and Tg, relation between Tm and Tg, dependence of Tm and Tg on copolymer composition, effect of chain length and crystallinity, energence of special properties.
Speciality polymers :
Liquid crystalline polymers, piezoelectric polymers, conductive polymers, temperature resistant polymers, polymer adhesive, biomedical polymers.
Synthesis, properties and applications:
of polythelene, polypropylene, polytetrafluroethylene pyolystyrene, polyvinyl chloride, polyisoprene, polybutadiene, neoprene, buna-N, buna-s, phenol-formal dehyde ureaformaldehyde, polyurethanes, epoxides, silicons, polyamides, cellulosics, reclaimed, rubber, recycling of plastics.

Reference Books / Suggested Readings:

1. Polymer science and Technology, II Edn, 2004 by J.R. Fried Person Education, Delhi.
2. Introduction to Polymers, 1981, by young, Robert, J.Chapson and Hall.
3. Principles of Polymerization, IV Edn, 2008, George Odians.
4. Text Book of Polymer Science, 3rd Edn, 1984, Fred W.Billmeyer, Jr, A. Wiley Insterscience Publication, NY.

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) VI Semester
PETROCHEMICALS (ICB-653)

Credits: 4
M. M.: 100 (30+70)
4 Periods/week

UNIT-I: **INTRODUCTION TO PETROLEUM & HYDROCARBONS.**

Origin and formation of Petroleum, Petroleum Reserves and Deposits, Composition of crude oil, Non-hydrocarbon components in Petroleum, Asphltenes and Resins.
Characterization of crude oil: TBP and ASTM distillation, Classification by chemical composition, Correlation Index, Density, API gravity, Viscosity, UOP characterization factor, etc. Physical & Thermal properties of petroleum, Petroleum products and their quality control.

UNIT-II: **PETROLEUM REFINING PROCESSES.**

Thermal conversion processes: Visbreaking, Delayed Coking, Fluid coking, Flexicoking, etc
Catalytic conversion processes: Fluid Catalytic Cracking, RFCC, DCC, Hydrocracking, Hydrotreating Processes, etc.
Catalytic Reforming, Alkylation, Polymerization, Isomerisation etc.

UNIT-III **PETROCHEMICAL TECHNOLOGY**
   (A) Technology for the production of Methanol, Ethylene oxide, Ethylene glycol and Vinyl Chloride, Acetic acid
   (B) Technology for the Production of acetone, acrylonitrile, linear alkyl benzene
   (C) Technology for the production of benzene, toluene, xylines, phenol, styrene
   (D) Technology for the production of isopropanol, butadiene, isobutene, isobutene

UNIT-IV **INDIAN PETROCHAMEICAL INDUTRY AND ENVIRONMENTAL CONCERNS**
Indian Petrochemical Industry: Indian reserves, Indian Refining Scenario, Quality control and Petroleum Distribution, Environmental concern and Emission Norms, Refinery waste Disposal Practices.

Reference Books / Suggested Readings:
   1. Hand Book of Petroleum refining Processes by ROBERT MEYERS, 3rd Edition, Tata McGraw Hill
   2. Chemistry of Petrochemical Processes by SAMI MATAR & LEWIS HATCH, 2nd Edition, Gulf Publishing Company
   3. Handbook of Petroleum, Product Analysis, JAMES G. SPEIGHT, John Wiley & Sons, Inc.,
   4. Petroleum Refining by Dr. B.R. Ram Prasad

INDUSTRIAL CHEMISTRY
DEPARTMENT OF CHEMISTRY
A.M.U., ALIGARH
B.Sc. (HONS.) VI Semester
FUEL CHEMISTRY **(ICB-654)**

Credits: 2
M. M.: 100 (30+70)
2 Periods/week

Lectures Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

UNIT 1
Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

UNIT 2
Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications.

UNIT 3
Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

UNIT 4
Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Reference Books: • E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK. • P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi. • B.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut