DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum under Choice Based Credit &

Grading System

M.Sc.

Analytical Chemistry

Semester–III & IV

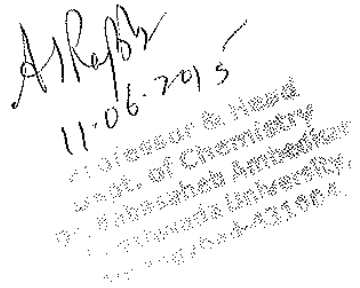
run at college level from the

Academic Year 2015-16 & onwards

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Chemistry

Revised Syllabus

M. Sc. III & IV Semester Analytical Chemistry



Effective from June 2014

The following will be the structure for revised syllabus for M.Sc. III & IV Semester Analytical Chemistry.

Semester	Paper No	Title of papers	Durations (Hrs.)	Marks Allotted	Credits
III Semester Theory Courses	CHE-313	Structural Elucidation By Spectral Method	60	50	4
	CHEA-314	Electro analytical Techniques	60	50	4
	CHEA-315	Environmental Analysis and Monitoring	60	50	4
	CHEA-316	Advanced Analytical Techniques	60	50	4
IV Semester Theory Courses	CHEA-417	Analysis of Ores, Alloys & Explosive	60	50	4
	CHEA-418	Food, Fertilizer & Pesticides Analysis	60	50	4
	CHEA-419	Petrochemical &Polymer Analysis	60	50	4
	CHEA-420	Pharmaceutical, Clinical & Forensic Analysis	60	50	4
III & IV Semester Laboratory Courses	CHEA- 421	Laboratory Course (Analytical)	135	50	4.5
	CHEA- 422	Laboratory Course (Analytical)	135	50	4.5
	CHEA- 423	Laboratory Course (Analytical)	135	50	4.5
	CHEA- 424	Project work (Analytical)	135	50	4.5

M. Sc. III Semester Anal. Chem

Structural Elucidation by Spectral Method- CHE-313

60hrs **Credits: 04**

UNIT-I ***Nuclear Magnetic Resonance Spectroscopy (^1H NMR)*** **[12hrs]**

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE), INEPT and INADEQUATE.

UNIT-II ***^{13}CNuclear Magnetic Resonance Spectroscopy*** **[12hrs]**

Elementary ideas, instrumental problems, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons); Effect of substituents on chemical shifts.

UNIT-III ***Mass Spectroscopy*** **[12hrs]**

Introduction, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

UNIT-IV **[12hrs]**

Problems based on joint applications of UV, IR, ^1H NMR, ^{13}C NMR and Mass spectroscopy.

UNIT-V **[12hrs]**

Mossbauer spectroscopy: Principle, factors affecting the line position and shape, isomer effect and Quadrupole splitting iron salt like compounds, complexes, carbonyl compounds (temperature dependence of isomer shift and Quadrupole splitting in simple compound and coordination, polynuclear complexes), Numericals.

Electron Spin Resonance Spectroscopy: Introduction, principle of ESR spectroscopy, presentation of spectrum, hyperfine splitting in various structures, hyperfine splitting digram of representative examples, factors affecting the magnitude of 'g' values, Zero field splitting, Kramer's degeneracy, Anisotropy in the hyperfine coupling constant, electron delocalization, instrumentation and applications.

Reference Books:

1. Introduction to Spectroscopy: D. L. Pavia, G. M. Lampman, G. S. Kriz
2. Spectrometric Identification of Organic Compounds: R. M. Silverstein & F. X. Webster
3. ^{13}C NMR Spectroscopy: G. C. Levy, R. L. Lichter, G. L. Nelson
4. Spectroscopic Methods in Organic Chemistry: D. H. Williams & I. Flemming
5. Absorption Spectroscopy of Organic Compounds: V. M. Parikh
6. Mass Spectrometry: K. G. Das & James
7. Coordination Chemistry by Experimental Methods: K. Barger
8. Coordination Chemistry vol. I: E. Martell
9. Physical Methods for Chemistry: R. S. Drago
10. Structural Methods in Inorganic Chemistry: E. A. V. Ebsworth& D. W. H. Rankin
11. Organic Structure Analysis: Philips Crews

M. Sc. III Semester Anal. Chem

Electro analytical Techniques- CHEA-314

60hrs **Credits: 04**

Unit-I General Introduction **[12hrs]**

Overview of Electrode Processes, Electrocapillary curve and electrocapillary maximum potential, exchange current, Ion selective electrodes: Types and construction of electrode, Glass electrode, Solid state electrode and precipitate electrode, Liquid-liquid membrane electrodes, Enzyme and gas electrode, Applications of ion selective electrodes, Reference electrodes, Mercury electrodes (DME, SME, HMDE), numericals.

Unit – II Potentiometry and Coulometry **[12hrs]**

Potentiometry: Introduction, Instrumentation, Various electrodes in potentiometry:- Ion selective electrode, Liquid membrane electrode, Weston cell. Potentiometric titrations:- Types of potentiometric titrations, Variations in potentiometric titrations, Limitations, Numericals. **Coulometry:** Introduction, Principle, Technique, Coulometry at constant current and coulometry at controlled potential, Coulometric titration, Flowing stream coulometry, Applications, Stripping analysis.

Unit- III Polarography and Cyclic Voltammetry **[12hrs]**

Theory and origin of polarography, Interpretation of pornographic curves, Instrumentation of polarography, Differential pulse polarography, Factors affecting on polarographic wave. Introduction and beginning of cyclic voltammetry Range of cyclic voltrametric techniques, Limitations. The acceptable sweep rate range, The shape of the peak in potential sweep curves, The role of non- aqueous solution in cyclic voltammetry, Crieteria of reversibility of electrochemical reactions Quasi reversible and irreversible processes, Qualitative and quantitative analysis by cyclic voltametric techniques, Linear sweep voltammetry for reactions that include simple adsorbed intermediates and Numericals.

Unit-IV **[12hrs]**

High frequency titration and Related Techniques:

Introduction, Theory and instrumentation, High frequency titrimetry, Types of cells, Advantages of high frequency methods and applications. Amperometric titration, Chronoamperometry, Chronopotentiometry and others

Unit-V **[12hrs]**

Electro-Gravimetry: Introduction, Theory of electrogravimetry, Terms used in electrogravimetric analysis. Completeness of deposition, Electroanalytical separation of metals, Applications.**Electrophoresis:**Introduction, Paper electrophoresis technique, Factors affecting migration of ions, Capillary and zone electrophoresis, Applications, Numericals.

Reference Books:

1. Quantitative analysis -. Alexeyev. V
2. Instrumental methods of analysis – Chatwal and Anand.
3. Introduction to instrumental analysis – R. D. Braun.
4. Instrumental methods of analysis – Willard, Meritt, Dean and Settle.
5. Standard methods of chemical analysis – F. G. Welcher, Vol III, Part A& B.
6. Electroanalytical chemistry – H. W. Neurenberg.
7. Principles of electrochemistry – D. A. Maclines.
8. Ion selective electrodes – (John Wiley) Stulic.
9. Vogel's textbook of quantitative chemical analysis V edition by Jeffery Bassett Mendham Denney.
10. Modern Electrochemistry vol. I - John O'M Bockris
11. Modern Electrochemistry vol. II - John O'M Bockris
12. Analytical Chemistry – Gary D. Christian, 6th edition
13. Principles of Instrumental Analysis–Skoog, F. J. Holler & J. A. Nieman.
14. Instrumental Methods of Chemical Analysis–Galen W. Ewing. 5th edition

15. M. Sc. III Semester Anal. Chem

Environmental Analysis and Monitoring- CHEA-315

60hrs **Credits: 04**

Unit-I Air Pollution [12hrs]

General considerations: polluted air, Types of pollution and units of measurements. Air quality standards, Sampling, Monitoring, Analysis of CO, Sources and sinks of CO pollution, Effects of CO on plants and humans, Control of CO pollution, Analysis of oxides of nitrogen, NOx sources and sinks of NOx pollution, Control of NOx pollution, Hydrocarbons and photochemical smog and its control, Analysis of hydrocarbon in exhaust gasses, Petrol and air, Sulpher di oxide sources, Analysis and control, Acid rain particulates and their effects on human and climate, Control of particulates.

Unit-II [12hrs]

a. **Water Pollution:** Aquatic environment, Water pollutants, Sampling of water and its preservation Trace metals in water, Chemical speciation with special reference to Copper, Lead, Mercury and Arsenic. Water quality standards Water quality parameters.
b. **Oxygen Demanding Wastes:** Dissolved oxygen, Biological oxygen demand, Monitoring techniques and methodology with special reference to ammonia, Nitrates, Nitrites, Fluorides, Cyanides, Total hardness, Lead, Cadmium and Mercury. Detection and control of Detergents, oils, Pesticides, Sewage treatment.

Unit-III [12hrs]

a) **Chemical toxicology :**Toxic chemicals in environment, Impact of toxic chemicals on enzymes, Biochemical effects of Arsenic, Cadmium, Lead, Mercury, Carbon monoxide, Sulphur dioxide, Pesticides and Carcinogens.
b) **Soil analysis:**Sampling of soil, Determination of water holding capacity, Determination of total nitrogen, phosphorous and sulphur in soil.

Unit-IV [12hrs]

Industrial pollution: Pollution due to cement industry, Distillery, Pharmaceutical (Drug) industries, Sugar industry, Paper and pulp industries, Thermal power plants, Nuclear power plants, Metallurgical industries, Polymer industries. Recycle, reuse, recovery, disposal,and management of solid industrial waste.

Unit-V : [12hrs]

GreenChemistry: Principle and concepts of Green Chemistry: Sustainable development and green chemistry, Atom economy,examples of atom economic and atom un-economic reactions,reducing toxicity.

Organic solvents: environmentally benign solutions,solvent free systems,supercritical fluids,ionic liquids as catalysts and solvents.

Emerging green technologies: Photochemical reactions (Advantages and challenges),examples, chemistry using microwaves, sonochemistry,electrochemical synthesis.

Designing greener processes: Inherently safer design (ISD),Process intensification(PI),in-process monitoring.

Reference Books:

1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd. New Delhi.
2. S. L. Chopra and J. S. kanwar, Analytical, Agricultural Chemistry, Kalyani Publishers, New Delhi.

3. R. K. Trivedy and P. K. God, Chemical and biological methods for water pollution studies, Environmental publications, co. New Delhi.
4. L. A. Richards, Diagnosis and improvement of saline and alkali soils. Oxford IBH publications co. New Delhi.
5. S. M. Khopkar, Environmentalchemistry, Environmental pollution analysis.
6. M. S. Creos and Morr, Environmental chemical analysis, American publications.
7. M. Sitting, Resources, Recovery and Recycling, Handbook of industrial waste.
8. Standard methods of water and waste water analysis, American public health association Washington D. C.
9. R. Gopalan and AmruthaAnand, "Environmental chemistry laboratory manual Emerald Publication.
10. Standards for water for drinking and other purposes, Beaurau of Indian Standards India.
11. Guideline for drinking water quality recommendations of world health organization, Geneva.
12. B. K. Sharma and H. Kaur, Environmental Chemistry, Guel publishing house Meerut.
13. Thomas G. Spiro and Willian M. Stigliani, Chemistry of environment.
14. Green Chemistry: An Introductory Text, Mike Lancaster, Royal Society of Chemistry,(2002)
15. New Trends in green Chemistry, V.K.Ahluwalia and M. Kidwai, Anamaya Publishers New Delhi, (2004)

M. Sc. III Semester Anal. Chem

Advanced Analytical Techniques- CHEA-316

60 hrs **Credits: 04**

Unit-I Molecular Luminescence Spectrometry: [12hrs]

Theory of fluorescence and phosphorescence, Instruments for measuring fluorescence and phosphorescence, Applications and photoluminescence methods, Chemiluminescence

Unit-IISurface Characterization by Spectroscopy and Microscopy: [12hrs]

Introduction to the study of surfaces, Spectroscopic surface methods, Ion spectroscopic techniques, Surface photons spectroscopic methods, Electron stimulated microanalysis methods, Scanning probe microscopes

Unit-III **[12hrs]**

a) Properties of Supercritical Fluids, Supercritical Fluid Chromatography, Supercritical Fluid Extraction.
b) Principle, Instrumentation and Applicationof the followings-
High performance thin layer chromatography, Ultra performance liquid chromatography, Advancedflash chromatography

Unit-IV **[12hrs]**

a) Radioactive Nuclides, Instrumentation, Neutron activation methods, Isotope dilution methods
b) Atomic X-ray spectrometry- Fundamental principles, Instrument components, X-ray fluorescence methods, X-ray absorption methods

Unit-V **[12hrs]**

a) Introduction, Need for hyphenation, Possible hyphenation, Interfacing devices and applications of the following: LC-MS, GC-IR, GC-MS,ICP-MS, MS-MS.
b) Principle of automation, Flow – injection Analysis, Microfluidics, Discrete automatic systems

Reference Books

1. Instrumental Methods of Analysis–Willard, Merritt, Dean & Settle.
2. Instrumental Analysis- Skoog, Holler, Crouch.
3. Principles of Instrumental Analysis–Skoog, F.J.Holler&J.A.Nieman
4. Instrumental Methods of Chemical Analysis–Galen W. Ewing.
5. Analytical Chemistry – Gary D. Christian, 6th edition
6. Handbook of Instrumental Techniques for Analytical Chemistry –Frank Settle,Editor
7. Introduction to Instrumental Analysis-R.D. Braun, McGraw Hill.
8. Fundamental of Analytical Chemistry,-D.A. Skoog, D.M.West and F.J. Holler.
9. Wilson and Wilson Compressive Analytical Chemistry. Ed. G. Svehla, A series of volumes.
10. Instrumental methods of analysis – Chatwal and Anand.
11. Instrumental methods of analysis – B. K. Sharma.

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M. Sc. IV semester Anal Chem

Analysis of Ores, Alloys &Explosive : CHEA-417

60 Hrs. **Credits: 04**

Unit-I [12hrs]

a. **Analysis of ores** Composition and analysis of Dolomite, Bauxite, Ileminite, Zinc blend and calcite for their major constituents using one of the standard methods of analysis.

b. **Analysis of alloys.**Composition, Properties, uses and analysis of :Brass, Bronze . Solder, Steel,Monel-metal, Silver coin for their major constituents using one of the standard methods of analysis.

Unit-II [12hrs]

Analysis of Paints and Pigments. Introduction, Determination of non-volatile and volatile components, Flash point, Separation of pigments and thinner of solvent type coating, Pigment type, Identification of binders , Analysis of Vehicle and drying oils,
Analysis of pigments: Classification of organic and inorganic pigments, White tinted pigments.

Unit-III [12hrs]

Analysis of Cement and buildingmaterials.: Types of cement, Sampling, Analysis of-Silicon dioxide, Aluminum oxides, Ferric oxides, Calcium oxide, Magnesium oxide, Sodium and potassium oxide.

Analysis of Glass: Types of glasses, Determination of lead and lead glass.

Unit-IV Explosive : [12hrs]

Explosion, Detonation, Classification of explosives, Propellant, Fulminates, Detonators, Blasting-cap, Thermochemistry, Hygroscopicity of explosives, Moisture by Karl-Fisher titration, Isolation from debris, Qualitative test, Cation& anion analysis by capillary electrophoresis, EDXRF, Analysis by TLC,HPLC, IR,GC-TEA method.

Unit-V Cosmetic Analysis. [12hrs]

a) Introduction to cosmetics.
b) Evaluation of cosmetic materials-raw materials, additives, colours, perfumes.
c) Legislation and recent amendments with respect to cosmetic materials.
d) Analysis of Physical and chemical constituents of : Skin powder , Creams , Lipsticks , Lotions

Reference books.

1. Hillenbrand Lhundel, Bright and Hoffman, Applied inorganic analysis, John Wiley.
2. Snell and Biffen, Commercial methods of analysis.
3. P. G. Jeffery, Chemical methods of rock analysis, pergamon.
4. Rieche, Outline of industrial organic chemistry, Butter worth.
5. Kent, Rieg's Industrial chemistry, Rain hold
6. P. G. Jeffery and. J. Hatchinsion, Chemical methods of rock analysis.
7. F. J. Welcher Standard methods of chemical analysis, A series of volume Robert and Krigeger Publishing Company.
8. Metallurgical analysis by S. K. Jain and K. K. Jain.
9. www.dghs.gov.in

M. Sc. IV semester Anal. Chem

CHEA:418- Food, Fertilizer & Pesticides Analysis

60Hrs **Credits: 04**

Unit-I General concepts of food analysis. **[12hrs]**

Nutrient value of food., Physical characteristics & chemical constituents , Proximate composition of food, Legislation related to food and recent amendments, Standards and public health, General idea regarding food processing and preservation, Food contamination and spoilage , Food safety considerations., Adulteration-Introduction,Types,Tests for adulterants, control

Unit-II Analysis of food- **[12hrs]**

Study of followings with their estimation methods : Food preservatives, Food emulsifiers, Food stabilizers,Food thickener, b). Introduction, Standard composition and Analysis of the following foods.:Milk and milk products, Tea, Coffee, Cereals & Flour, , Honey, Soft drinks & Alcoholic beverages.

Unit- III **[12hrs]**

Analysis of Oils, Fats Soap and Detergents Introduction to natural oils and fats, Analysis of oils and fats, Softing point, Congent point, Titer point, Cloud point, Iodine, Saponification, acid, Hydroxyl, R-M andpolenske values, Elaiden test. Introduction to soaps, Analysis of soaps, for saponification, Unsaponifiable and unsaponified matter in soaps, Estimation of free alkali and phenol in soap, Classification of detergents (in Brief), Analysis of active ingredients from detergents (methelene blue and hyamine 1622 method), Estimation of CMC, Chlorides, Total phosphates

Unit-IV **[12hrs]**

Analysis of fertilizers. Classification of fertilizer, NPK value, Chemical composition of superphosphate, Lime and Potash fertilizer, Analysis of commercially available fertilizers for N, P & K. **Analysis of pesticides.** :Legislation and recent amendments with respect to pesticides materials. Names of pesticides and their chemical structures. , Application dosage of different pesticides. , Analysis of specific pesticides.

Unit-V Analysis of Vitamins **[12hrs]**

Analytical techniques of determination of water and fat soluble vitamins including , crobiological techniques. **Human nutrition:** Biological values and estimation of enzymes, Carbohydrates, essential amino acids, proteins and lipids.

Reference Books:-

1. Chemical analysis of food By Pearson.
2. Introductions to food science and technology , food science and technology series by G.F.Stewart and M.A. Amerine Academic process.
3. Cosmetics by W.D. Poucher (Three volumes)
4. Applied chemistry .AText book for Engineers and technologists by H.D.Gesser.
5. Food analysis by Nielson.
6. Food additives by S.N.Mahindry (APH) publication
7. Analytical chemistry by Dr.Alka Gupta (pragatiprakashan)
8. Jacob(M.B) chemical Analysis of food and food products, (Van Nostrand co. New York)
9. Analytical chemistry of foods (C.S.James) Blackie Academic and professional
10. Food Analysis principles and techniques D.W.Gruenwedel and J.R.Whitaker, Mercel Dekker
11. Food analysis Theroy and practice Y.pomeranz and C.E.Meloan,Chapman and Hill
12. Food Analysis ,2nd edition S.S Nelsen, Aspen publishers
13. Chopra S.L and Kanwar:J.S.1991 Analytical agricultural chemistry,Kalyanipublishera,New Delhi Ludiana India
14. Food analysis, A. G. Woodman, McGraw Hill

M. Sc. IV semester Anal. Chem

Petrochemical &Polymer Analysis : CHEA-419

60Hrs **Credits: 04**

Unit-I polymer:- **[12hrs]**

Introduction, classification of polymer, condensation polymerization, Addition polymerization. Mechanism, and stereochemistry of addition polymerization, Free redical addition polymerization,Cationic addition polymerization,Anionic addition polymerization Chain transfer reaction, Branching and cross linking in free radical addition polymerization, Ionic copolymerization,co-polycondensation Ring opening polymerization,Group transfer polymerization. .Co-ordination polymerization. Molecular mass, Number and mass average molecular mass, Molecular mass determination by osomometry, Viscometry, light scattering and Sedimentation methods, Kinetics of polymerization Numericals

Unit-II Study of individual polymers:- **[12hrs]**

Preparation and applications of following polymers:- polyethylene, polystyrene polyacrylonitrile polyesters polyparaphenylene polycarbonates polyamides, polyethylene glycol polypropylene alcohol, polyvinyl chloride polytetrafluoethylene, silicone polymers.

Unit-III Polymer degradation:- **[12hrs]** Introduction, Types of degradation .Thermal degradation, Mechanical degradation, photo degradation, Degradation by high energy radiation .Degradation by ultrasonic wave. Oxidative degradation.Ozone oxidation degradation .oxidative degradation of saturated polumers.Oxidation of phenol, formaldehyde.Antioxidants.

Unit-IV.Fuels:- **[12hrs]**

Introduction, calorific value.Determination of calorific value.Modern concept of fuels. Classifications of fuels ,criterion of selection of fuels , properties of fuels. Method of processing. Solids fuels ,Natural solid fuels, Artificial solid fuels ,Industrial solids fuels .Formation of coal properties of coal ,Classification of coal., coking and non-coking coals. pulverised coal. .Role of sulphur and ash in coal ,approximate analysis ,Ultimate analysis. .Numerical.

Unit-V Petroleum:- **[12hrs]**

Occurrence, mining of petroleum. Prospecting colour and consistency. Origin composition, classification ,terms related to petroleum. .Distillation of crude petroleum.Treatment of the residual liquid, Determination of flash point. Determination of aniline point .Knocking and Anti-knocking compounds. Octane number .Cetanenumber,Numericals.

Reference Books:-

1. Text Book of polymer science By F.W.Billmeyer, New York: Wiley
2. Physical polymer science by L.H .Sperlingwiley –Interscience New York
3. Fundamentals of polymer science & Engineering By A Kumar &S.K.Gupta,Tatamcgraw Hill
4. Introduction to polymer science ,V.R.Gowarnikar, N.V.Vishwanathan& J.
5. Industrial Chemistry, B. K. Sharma, Goel publishing House Meerut.
6. Kent, Rieg's Industrial chemistry, Rain hold.
7. Handbook of Instrumental Techniques for analytical chemistry. Frank Settle, editor 1st Indian print 2004.
8. Polymer science by VasantGovarikar, Wiley Earstewen. New York.
9. Principle of polymer science, Behadhar and Sastri, Narosa Publishing house.

M. Sc. IV semester Anal. Chem

Pharmaceutical, Clinical & Forensic Analysis : CHEA-420

60Hrs **Credits: 04**

Unit-I Pharmaceutical Analysis-I [12hrs]

General idea regarding pharmaceutical industry. Definition and classification of drugs, types of dosage forms. Introduction to pharmaceutical formulations, Sources of impurities in pharmaceutical chemicals, raw materials & Products,. Standardization of finished products& their characteristics. Limit tests of As, Hg, Cu, Pb, Fe, Cl and SO_4, Solubility tests, disintegration tests, stability studies.

Unit-II [12hrs]

Pharmaceutical legislation: Introduction to drug acts, drug rules,FDA and ISO standards & their amendments , ISO-9000, an overview, Clauses / requirement of ISO-9000, Significance and scope. Steps for ISO-9000, implementation, Series of ISO, Case studies of ISO. ISI, Agmark and other standard for goods & cosmetics particularly w.r.t. the testing of drugs, and raw material concerned.Pharmaceutical standards BP/IP/USP/NE/EP.Documentation, Record Keeping. Contents of labels ,Types of packaging materials

Unit-III [12hrs]

Clinical Analysis.: Introduction: Body fluids: Composition, Collection and Preservation of body fluids and detection of abnormal levels of certain constituents leading to diagnosis of diseases and disorders.Analysis of constituents of physiological fluids, viz.1.Blood -PH, Glucose, Urea. 2.Serum-uric acid, total protein,albumin,globulin&A/G ratio, barbiturates, alkaline phosphatase, acid phosphatase,bilurubin, cholesterol, amylase, creatinine carbohydrates..Urine-Immunological methods: General process of immune response, Antibody-Antigen ratio, Precipitation reactions, Enzyme and fluoro-immune assays radioimmunoassay, ELISA

Unit-IV [12hrs]

Forensic Analysis. Introduction, Special features of forensic analysis, Sampling, Sample storage, Sample dissolution.Toxicology: Classification of poisons and poisoning, Lethal Dose, Significance of LD50 and LC50. Extraction methods in toxicology: Isolation, Identification and determinations of: Narcotics: Heroin, Morphine, Codeine. Stimulants: Caffeine, Cocaine, Amphetamines.Despressant: Benzodiazepines- Diazepam, Oxazepam, Nitrazepam. Barbiturates- Phenobarbitone, Amylobarbitone, Pentobarbitone, Thiopentone.Hallucinogens: LSC and Cannabis.Analysis of biological stains and materials including blood, semen and saliva (qualitative and quantitative). Viscera, Stomach wash, Vomit and post mortem blood for poisons like cyanides, As, Hg, Insecticides and Pesticides.

Unit-V Pharmaceutical Analysis-II [12hrs]

Assay of main classes of drugs with reference to Introduction, Type, Properties, Mode of action and Methods of Analysis.

Reference Books:

1. General Microbiology- R. V. Stainer 6th edition
2. Principle of microbiology- A. J. Salle
3. Microbiology- Pleczar
4. Isolation and Identification of drug-n E. G. Clarke vol.- I
5. Laboratory procedure manual-Forensic Toxicology- Directorate of forensic science, MHA Govt. of India.
6. Analytical Biochemistry, D. J. Holme and H.Peck, Longman
7. BioanalyticalChemitry,S.R. Mikkelsen and E. Corton, John Wiley and Sons.
8. Immunoassay – a practical guide Eds,D.W.Chan and M.T.Perlstein, Academic Press.
9. Hawk's Physiological Chemistry, McGraw Hill.
10. Pharmaceutical Analysis Edited by David C. Lee, and Michael Webb.
11. An Introduction to Practical Biochemistry, David Plummer.
12. Biochemical methods, S. Sadasivam, A.Manickam.
13. Standard Methods of Biochemical Analysis, S.R. Thimmaiah

M. Sc. III & IV semester Anal. Chem

Laboratory Course (Analytical) CHEA- 421

135 Hrs **Credits: 4.50**

Name of experiment.

1. Determination of COD, BOD and dissolved oxygen from waste water sample.
2. Determine the amount of magnesium of from Neem plant leaves sample by
3. volumetric method.
4. Separate and estimate the amount of cadmium and zinc using ion exchange resin
5. Removal of dyes by column chromatography method using activated charcohol
6. Estimation of Nitrogen from given sample of fertilizer by Kjaldal method.
7. Determination of acid and Iodine value of an oil.
8. Determination Vitamin –C from given sample of Juice/ tablet using dichlorophenol indophenols by volumetric method.
9. Estimation of blood glucose by Folin Wu method.
10. Estimation of API in the pharmaceutical sample.
11. Determine the molecular weight of high polymer by viscosity measurement.
12. Estimation of phenol / aniline by bromination method.
13. Estimation of chloride from food sample by Volhard titration method.
14. Determination of sodium carbonate in washing soda .
15. Determination of volume strength of commercial hydrogen peroxide using $KMnO_4$
16. Estimation of Nickel in the given solution by EDTA titration method.
17. Estimation of tannine from tea sample
18. Estimation of Iron by 8- hydroxyl quinoline by solvent extraction .
19. Estimation of nickel using 1,10 phenonthroline and dithiazone by solvent extraction
20. . Separation and estimation of bromophenolblue ,congo red and phenol red in a mixture by thin layer chromatography.

Reference Books

1. Quantitative Inorganic Analysis including Elementary Instrumental Analysis
by A. I. Vogels, 3rd Ed. ELBS (1964)

2. Experiments in chemistry by D. V. Jahagirdar, Himalaya publication

3: Practical Pharmaceutical Chemistry, 4th Ed. part-2, Beckette, Stenlake

M. Sc. III & IV semester Anal. Chem

Laboratory Course (Analytical) CHEA- 422

135 Hrs **Credits: 4.50**

Name of experiment.

1. Estimation of potassium and sodium from given sample of fertilizer using flame photometric method.
2. Estimation of calcium from given sample of milk using flame photometric method.
3. . Determine the strength of acetic acid and sulphuric acid from mixture of acid solution using conduct metric method.
4. Analysis of commercial vinegar by conductometric titration method.
5. Determination of relative strength of acetic acid, chloroacetic acid and trichloro acetic acid Ka value by conductometric metric method.
6. Determination of boric acid by conductometric method.
7. Determination of commercial vinegar by potentiometric titration and its confirmation by conductometric method.
8. .Determination of percentage of sodium carbonate from soda ash by P^H metric titration method.
9. Determine the percentage of phosphoric acid in cold drink sample by spectrophotometric method.
10. . Determine the amount of phosphate from given sample of fertilizer/ detergent using spectrophotometric method.
11. Estimation of Cu(II) and Fe(III) by specrophotometric method using EDTA .
12. Determine the amount of alcohol from given sample of by Spectrophotometric method.
13. Estimate the reducing sugar by 3,5dinitrosalicylic acid in the given food sample by Spectrophotometric method..
14. Determination of protin by biureate method using by Spectrophotometric method.
15. Determination of moisture contain in food sample using Karl fischer titration method.
16. . Determine the specific and molar refraction of given liquid by refractometric method.
17. Analysis of mixture of alcohols by Gas chromatography
18. Monitoring of nitration of organic compound by gas chromatography.
19. Determine the lactose sugar by HPLC method
20. Analysis of binary mixture of simple organic compound by HPLC method.
21. Determine the Hammett constant of substituted benzoic acid by pH metric method.

M. Sc. III & IV semester Anal. Chem

Laboratory Course (Analytical) CHEA-(a& b) 423

135 Hrs **Credits: 4.50**

Part – I Name of experiment

1. Estimate the amount of copper and Tin from bronze alloy
2. Estimate the amount of lead and Tin from solder alloy
3. Estimate the amount of copper and Nickel from coin
4. Estimate the amount of copper and Zinc from brass alloy
5. Estimate the amount of Iron Tin from heamatite ore.
6. Estimate the amount of calcium , Magnesium and silica material from dolomite ore.
7. Estimate the amount of SiO_2, calcium Iron Magnesium and aluminiumfro cement.
8. Determine the amount of Nickel and Iron from $NiFe_3O_4$ ferrite sample.

Part B- Analytical Data interpretation and Structure Elucidation

i). UV Visible, IR , PMR, CMR mass Spectrum of organic and inorganic compounds

ii). XRD data analysis of organic and inorganic compounds

iii). TGA, DTA data analysis of inorganic compounds

References books for CHEA422-to 424

1. Systematic experimental physical chemistry – S. W. Rajbhoj& T. K Chondhekar
2. Quantitative Inorganic Analysis including Elementary Instrumental Analysis
3. by A. I. Vogels, 3rd Ed. ELBS (1964)
4. 3: Standard methods of chemical analysis by F. J. Welcher
5. 4: Indian Pharmacoepia volume –I , II III
6. British pharmacopeia -
7. Experiments in chemistry by D. V. Jahagirdar, Himalaya publication
8. 7: Practical Pharmaceutical Chemistry, 4th Ed. part-2, Beckette, Stenlake
9. 8: Standard Instrumental methods of Chemical Analysis, F. J. Welcher

M. Sc. III & IV semester Anal. Chem

Project work (Analytical Chemistry) CHEA- 424

135 Hrs **Credits: 4.50**

Tentative topic for projects

Projects to be based upon convenient analytical protocol for analysis of one of the following materials

i) Drugs/ Medicines

ii). Dyes/ Paints/ cosmetics

iii). Milk product/ vegetable oils/ beverages

iv). Plastics and polymers

v) Ores & alloys

vi) Fertilizer, insecticide, Pesticide , Plant material analysis

vii). Environmental samples, air, water, soil

Scheme of marking

Project work Evaluation : 25 marks

i. Literature survey

ii. Experimental procedures, photographs

iii. Characterizations techniques : Fundamentals principles of respective techniques

iv. Spectrum / images of prepared materials

v. Data analysis / applications of synthesized materials

vi. Conclusion

vii. Reference citations

viii. Holistic response of students (scientific thinking, power of imagination, Punctuality, efforts, curiosity,)

Power point presentation of Project work : 25 marks

i. Self-preparation PPT

ii. Skill of presentation

iii. Contents of presentation

iv. subject knowledge

v. Manuscript preparation/acceptance/publication

Reference : Internet search