AC 27/2/13

Item no. 4.119

UNIVERSITY OF MUMBAI

Syllabus for Sem III and IV
Program: M.Sc.(PSCHA)
Course: Analytical Chemistry

Credit based semester and grading system with effect from the academic year 2013-2014

UNIVERSITY OF MUMBAI

M.Sc. ANALYTICAL CHEMISTRY
Semester III and IV
Credit Based Semester and Grading System
To be implemented from the Academic year 2013-2014

SEMESTER III

Course Code	UNIT	TOPICS	Credits	L/Week
PSCHA301	I	Quality in Analytical Chemistry – I	4	1
	II	Quality in Analytical Chemistry – II		1
	III	Chromatographic Techniques - I		1
	IV	Chromatographic Techniques - II		1
PSCHA302	I	Spectral methods - I	4	1
	II	Spectral methods - II		1
	III	Electroanalytical methods		1
	IV	Advanced Miscellaneous techniques		1
PSCHA303	I	Air pollution	4	1
	II	Potable Water - I		1
	III	Other types of pollution		1
	IV	Industrial materials		1
PSCHA304	I	Analytical Biochemistry	4	1
	II	Immunological methods		1
	III	Food analysis - I		1
	IV	Food analysis - II		1
PSCHA 3P1 PSCHA 3P2 PSCHA 3P3 PSCHA 3P4	Practicals		8	16

SEMESTER IV

Course Code	UNIT	TOPICS	Credits	L / Week
PSCHA401	I	Safety and Research	4	1
	II	Membrane separation and automated techniques		1
	III	Green Chemistry		1
	IV	Advanced technology		1
PSCHA402	I	Spectral methods - III	4	1
	II	Spectral methods - IV		1
	III	Radiochemical and thermal methods		1
	IV	Hyphenated techniques		1
PSCHA403	I	Potable Water - II	4	1
	II	Solid waste management		1
	III	Plastics and polymers		1
	IV	Metallurgy		1
PSCHA404	I	Pharmaceutical analysis	4	1
	II	Drugs		1
	III	Forensic science and Cosmetics		1
	IV	Cosmetic analysis		1
PSCHA4P1 PSCHA4P2 PSCHA4P3 PSCHA4P4	Practicals		8	16

UNIVERSITY OF MUMBAI

M.Sc. ANALYTICAL CHEMISTRY
SEM – III
PSCHA 301

QUALITY IN ANALYTICAL CHEMISTRY

UNIT – I : QUALITY IN ANALYTICAL CHEMISTRY - I 1.1 Sampling: Definition, types of sample, sampling plan, quality of sample, sub-sampling, sample registration and storage, acceptance sampling – inspection by attributes. (5L) 1.2 Selecting the method: Factors to consider in choosing a method, performance criteria for methods to determine analyte in samples with the complex matrix, reasons for incorrect analytical results, validation of analytical method (5L) 1.3 Measurement and reporting: Good laboratory practices, calibration of measurements, record management, quality control, charting and reporting results (5L)	15
UNIT – II : QUALITY IN ANALYTICAL CHEMISTRY - II 2.1. Measurement of uncertainty: Definition and evaluation of uncertainty, putting uncertainty to use, interpretation of results and improving the quality of results (4L) 2.2 Signal to noise : Signal to noise ration ratio, sources of noise in instrumental analysis. Signal to noise enhancement, hardware devices for noise reduction, software methods of noise reduction. (6L) 2.2. Pharmaceutical Legislation: Introduction to phase diffusion methods and drug acts, Drug rules (schedules), FDA and ISO standards, ISO9000 and its requirements, GMP (5L)	15
UNIT – III : CHROMATOGRAPHIC TECHNIQUES -I 3.1. Ion exchange chromatography: Ion exchange equilibria, break through capacity, ion exchange in non aqueous media, Inorganic ion exchangers, synthetic ion exchangers, liquid cation and anion exchangers, chelating resins and their applications for separation of inorganic and organic compounds, Ion chromatography: Principle, Instrumentation with special reference to separation and suppressor columns and applications (10L) 3.2 Supercritical fluid extraction: concept of critical state of matter and super critical state, types of super critical fluids, apparatus and applications to environmental, food, pharmaceuticals and polymeric analysis(5L)	15

UNIT – IV : CHROMATOGRAPHIC TECHNIQUES -II 4.1 Theory, instrumentation and applications of: 4.1.1. Exclusion chromatography, gel permeation, retention behavior, inorganic molecular sieves, determination of molecular weight of polymers (4L) 4.2.2 Super Critical fluid Chromatography (4L) 4.2.3 Inverse gas chromatography (4L) 4.2.4 Affinity Chromatography (3L)	15

List of books and references:

1. Quality in the analytical chemistry laboratory, E Prichard, John Wiley and sons N.Y 1997.
2. Quality assurance in analytical, W Funk, V Dammann, G. Donnevert VCH Weinheim 1995.
3. Fundamentals of Analytical Chemistry, D. A. Skoog and D. M. West, Saonders, college publication.
4. Chemical methods of separation, J A Dean, Van Nostrand Reinhold, 1969
5. Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969.
6. Analytical Chemistry Christain, Wse / Wiley
7. Extraction Chromatography T. Braun, G. Ghersene, Elsevier Publications 1978.
8. Super critical fluid extraction Larry Taylor Wiley publishers N.Y. 1996
9. Ion exchange separation in analytical chemistry O Samuelson John Wiley 2nd ed 1963
10. Ion exchange chromatography Ed H.F Walton Howden, Hutchenson and Rossing 1976
11. Chromatographic and electrophoresis techniques I Smith Menemann Interscience 1960

PSCHA302

ADVANCE INSTRUMENTAL TECHNIQUES

UNIT -1: SPECTRAL METHODS - I: Principle, instrumentation and applications of the following: 1.1 Electron Spectroscopy: AUGER, ESCA and UPS (8L) 1.2 Electron Microscopy:(7L) Scanning Electron Microscopy : Scanning electron microscope Scanning Tunnelling Microscopy: Scanning probe microscopes (scanning tunneling microscope and Atomic force microscope)	15
UNIT -2: SPECTRAL METHODS - II 2.1 Photoacoustic spectroscopy (5L) 2.2 Atomic emission spectroscopy with plasma and electrical discharge sources (5L) 2.3 Mossbauer's Spectroscopy (5L)	15
UNIT-3: ELECTROANALYTICAL METHODS-1 3.1 Electrochemical biosensors: Disposable multilayered p-ion system, Screen printed Electrodes (3L) 3.2 Chronopotentiometry and chronoamperomrtry (4L) 3.3 TAST : Principle, instrumentation and applications (3L) 3.4 Applications of voltammetry in organic and inorganic analysis (2L) 3.5 Chemically and electro-catalytically Modified electrodes used in voltammetry (3L)	15
UNIT-4: ELECTROANALYTICAL METHODS-2. 4.1 CHEMILUMINESESCENCE METHODS: Principle, Apparatus, Quantitative Chemiluminescence - Gas phase and liquid phase chemiluminescent analysis and titrations (7L) 4.2 Principle, instrumentation and applications of Polarimetry : ORD, CD (5L) 4.3 Principle, instrumentation and applications of Photoacoustic spectroscopy (3L)	15

List of books and references:

1. Analytical Chemistry, G. D. Christian, 4th Ed. John Wiley, New York (1986)
2. Fundamentals of Analytical Chemistry, D .A. Skoog and D. M. West and F. J. Holler Holt-Saunders 6th Edition (1992)
3. Principles of Instrumental Analysis, D. A. Skoog, F. J. Holler and J.A. Niemann, 5th Edition (1998)
4. Instrumental methods of Analysis, H. H. Willard, L. L. Merritt, Jr. J. A.Dean and F. A. Settle Jr 6th Ed CBS (1986)
5. Instrumental methods of Analysis, H. H. Willard, L. L. Merritt Jr, J. A. Dean and F. A. Settle Jr 7th Ed CBS (1986)
6. Introduction to instrumental analysis, R. D. Braun, Mc Graw Hill (1987)
7. Electrochemical Methods, A. J. Bard and L.R. Faulkner, John Wiley, New YORK, (1980)
8. Electroanalytical Chemistry, J.J . Lingane, 2nd Ed Interscience, New York (1958)
9. Modern Polarographic Methods in Analytical Chemistry, A. M. Bond, Marcel Dekker, New York, 1980.
10. Electroanalytical Chemistry, Ed A. J. Bard and Marcel Dekker, New York, (A series of volumes)
11. Techniques and mechanism of electrochemistry, P. A. Christian and A. Hamnett, Blachie Academic and Professional (1994)
12. Wilson and Wilson's Comprehensive Analytical Chemistry, Ed. G. Svehla. (A series of Volumes)
13. Treatise on Analytical Chemistry, Eds. I. M. Kolthoff and Others, Interscience Pub. (A series of volumes).
14. Standard Methods of Chemical Analysis, Eds. F. J. Welcher, Robert E. Krieger Publishing Company, (A series of volumes)
15. Polarographic Methods in Analytical Chemistry, M. G. Arora, Anmol Publications Pvt Ltd

PSCHA303

ENVIRONMENTAL AND CERTAIN INDUSTRIALLY IMPORTATNT MATERIAL

UNIT –I: AIR POLLUTION 1.1 Sources, Classification, Pollutants and permissible limits.(3L) 1.2 Sampling methods for air, flew gas, Industrial Exhaust, stag samples etc. (3L) 1.3 Importance of automobile exhaust control and its limits(2L) 1.4 Sampling and analysis of : Particulate matter, aerosols, ammonia and organic vapours.(3L) 1.5 Carbon credit and global issues related to air pollution.(3L) 1.6 Green house gases and their substitutes(1L)	15
UNIT – II: POTABLE WATER - I 2.1 Water: Quality and requirements of potable water.(2L) 2.2 Direct and indirect pollutants for potable water reservoirs.(3L) 2.3 Quality of potable water from natural sources.(1L) 2.4 Bore well water quality and analytical parameters.(2L) 2.5 Quality of bottled mineral water(2L) 2.6 Process of purification of bore well water to bottled mineral water.(3L) 2.7 Documentation and certification for marketing of mineral water(2L)	15
UNIT – III: OTHER TYPES OF POLLUTION 3.1 Soil pollution: Source, Soil analysis, Fertility of solid and effect of pollution on it, water binding capacity of the soil, Organic fertilizers and their long term effect on soil quality.(2L) 3.2 Noise Pollution: source, effects, methods of measurements and control measures.(2L)	15

3.3 Thermal Pollution: definition, source, impact, control measures, working of cooling towers and cooling ponds, involved economy.(3L) 3.4 Radioactive pollutants: Source, exposure hazards, precautions in handling and safety , Long term effects.(2L) 3.5 Allergy: Definition, Role of pollutants, Effect on human health, safety and protection methods, medicines and allergy treatment wrt pollutants.(2L) 3.6 Environmental Legislation: role of pollution control boards, article 48A and 51A, motor vehicle act and method of analysis with respect to PUC.(2L) 3.7 Environmental Audits: Concept of audit, Authorities, Evaluation methodology, benefits and certification(2L)	
UNIT – IV: INDUSTRIAL MATERIALS 4.1 Insecticides and Pesticides: Definition, classification, determination as pollutant, Biodegradation of Insecticides and Pesticides.(2L) 4.2 Determination of Chloride, sulphur by chromatographic method.(2L) 4.3 Detergents: Classification, composition of detergents with role of ingredients.(2L) 4.4 Qualitative and quantitative analysis of ingredients of detergent.(2L) 4.5 Properties of detergents: Alkalinity, Anionic matter, Oxygen release capacity etc and selection criteria.(2L) 4.6 Petrochemical products: crude oils, fuels and calorific values, fractional distillation process and fractions, properties of fuels, compositions of fuel, flash point, fire point, corrosion test carbon residue and impact on environment.(5L)	15

List of books and References:

1. Environmental Chemistry, A. K. De, 2nd ED. Wiley (1989).
2. Environmental pollution analysis, S. M. Khopkar, John Wiely (1993).
3. Air pollution sampling and analysis, Sharad Gokhale, IIT Guwahati, May 2009.
4. Environmental Pollution Analysis, S. M. khopkar, New Age International publication (2011).
5. Water and water pollution (hand book) Ed., Seonard'l Ciacere, Vol I to IV, Marcel Dekker inc. N.Y.(1972)
6. Water pollution, Arvind kumar, APH publishing (2004)
7. Introduction to Potable Water Treatment Processes Simon Parsons, Bruce Jefferson, Paperback publication.
8. Guidelines for drinking-water quality, third edition, (incorporating first and second addenda). WHO report.
9. Soil pollution, S.G. Misra and Dinesh Mani, APH Publishing Corporation, (2009).
10. Soil Pollution: origin, monitoring and remediation, Abrahim Mirsal, Springer (2010).
11. Noise Pollution, Donald F Anthrop, Lexington Books, (1973)
12. Noise Effects Handbook: A Desk Reference to Health and Welfare Effects of Noise (1981) Available at NCL laboratories e- Library.
13. Chemistry, Emission Control, Radioactive Pollution and Indoor Air Quality Edited by Nicolas Mazzeo, InTech Publications (2011).
14. Environmental Protection Against Radioactive Pollution: N. Birsen, Kairat K. Kadyrzhanov, Springer publication , (2003).
15. The complete allergy book, June Engel and Isolde Prince, Firefly Books, (1998).
16. Environmental law in India, Mohammad Naseem, Wolters Kluwer.
17. *Environmental* Protection, *Law* And Policy In *India* Kailash Thakur google books (1997).
18. Green chemistry An Introductory text, Mzike Lancaster, Royal Society of Chemistry (2002)
19. Pesticide Analysis Ed K. G. Das, Dakker (1981)

PSCHA304

Pharmaceutical, Biochemical and organic analysis

UNIT I: ANALYTICAL BIOCHEMISTRY : 1.1 Body fluids 1.1.1 Composition of body fluids and detection of abnormal levels of certain constitutents leading to diagnosis of disease. 1.1.2 Physiological and nutritional significance of water and fat soluble vitamins and minerals. 1.1.3 Analysis for constituents of physiological fluids, viz., urine, blood, serum. 1.1.4 Analytical techniques for vitamins including microbiological techniques.	15
UNIT II: IMMUNOLOGICAL METHODS 2.1 General processes of immune response, Antigen-antibody reactions, precipitation reactions, radio, enzyme, and fluoro-immuno assays. 2.2 Human nutrition : Biological values and estimation of enzymes, carbohydrates, essential amino acids, proteins, and lipids.	15
UNIT III: FOOD ANALYSIS-1 3.1 Food legislation and public health (5L) 3.2 Fuel value of food, general idea regarding food processing and preservation (5L) 3.3 Food Packaging : Introduction, types of packing materials and properties, Industrial Requirements (5L)	15
UNIT IV: FOOD ANALYSIS-2 3.1 Analysis of food : Milk and milk products, Tea, Coffee, Flour, Starch, Honey, Jam, Oils (8L). 3.2 Analysis of food related materials: Preservatives, Coloring matter, trace metals, pesticide residues (7L)	15

List of books and References:

1. General, organic and biological chemistry, H. Stephen Stoker, Cengage Learning.
2. Advance dairy chemistry, vol 3, P. F. Fox, P. L. H. McSweeney Springer.
3. Physiological fluid dynamics vol 3, Nanjanagud Venkatanarayanasastry Chandrasekhara Swamy Narosa Pub. House, 1992
4. Molecular Biological and Immunological Techniques and Applications for food, edited by Bert Popping, Carmen Diaz-Amigo, Katrin Hoenicke, John Wiley & sons.
5. Food Analysis: Theory and practice, Yeshajahu Pomeranz, Clifton E. Meloan, Springer.
6. Principles of package development, Gribbin et al
7. Modern packaging Encyclopaedia and planning guide, Macgra Wreyco.
8. Food Analysis, Edited by S. Suzanne Nielsen, Springer
9. Analytixcal Biochemistry, D, J. Homes and H. Peck, Longman (1983)
10. Bioanalytical Chemistry, S. R. Mikkelesen and E. Corton, John Wiley and sons 2004
11. Analysis of food and beverages, George Charalanbous, Accademic press 1978.

Practical course

PSCHA3P1 Group – A: Instrumental Analysis

1. Determination of the pK value of an indicator.
2. Determination of aniline and ethanolamine in a mixture of two in acetonitrile by potentiometric titration.
3. Determination of sulphate by Nephelometry.
4. Determination of mixture of halides potentiometrically.
5. Estimation of strong acid, weak acid and salt in the given mixture conductometrically.
6. Polarographic (sample DC) determination of cadmium in the given sample.
7. Determination of Copper and lead in the given sample by simultaneous electrogravimetry.
8. Analysis of mixture of carbonate and bicarbonate (present in ppm range) using pH metry.

PSCHA3P2 Group – B:Analysis of medicinals ,Organic analysis, Biochemical analysis

1. Estimation of drugs by non aqueous titration: Pyridoxine hydrochloride, Mebendazole, Diazepam
2. Determination of percentage purity of methylene blue indicator.
3. Estimation of cholesterol and Uric acid in the given sample of blood serum
4. Estimation of Aspirin by conductometry
5. Analysis of Whitfield ointment.
6. Estimation of fluoride in a tooth paste

PSCHA3P3 Group – C: Analysis of Food and oil samples

1. Total reducing sugars before and after inversion in honey using:
   (a) Cole's Ferricyanide (b) Lane - Eynon method.
2. Analysis of lactose in milk
3. Estimation of Caffein in tea
4. Estimation of Vitamin C in lemon Juice/squash
5. Iodine value of oil / fat
6. Analysis of alcoholic beverages (bear) for alcohol containt.

PSCHA3P4 Group – D: Metallurgy and water Analysis

1. To analyze Pyrolusite for: Fe and / or Mn.
2. To analyze galena for: Pb
3. Analysis of cupronickel : Ni^{2+} and / or Cu^{2+} titrimetrically
4. Analysis of water sample: Total Hardness and alkalinity,
5. Analysis of water sample: TDS, salinity and free chlorine,
6. Analysis of water sample: acidity and Sulphate (benzidin method)
7. Estimation of Fe in a sample containing Fe + Ni by solvent extraction

UNIVERSITY OF MUMBAI

M.Sc. ANALYTICAL CHEMISTRY
SEM – IV

PSCHA401
QUALITY IN ANALYTICAL CHEMISTRY

UNIT – I: SAFETY AND RESEARCH 1.1 Safety: Safety in chemical laboratory and plants, material handling, storage of raw material and finished goods, hazardous codes and transportation symbols, method of transportations, certification for transportation, first aid methods and treatments (6L) 1.2 Patent: Introduction, patenting process and requirements of patenting (5L) 1.3 Chemical standards and reference materials, pharmacopoeia (BP, IP) material standards (ASTM), Chemical grades (commercial , GR, LR and AR grades) (4L)	15
UNIT – II: MEMBRANE SEPARATION AND AUTOMATEDS ANALYSIS 2.1 Membrane separation processes: Operating principles and applications of microfiltration, ultra-filtration, reverse osmosis, dialysis and electro-dialysis (9L) 2.2 Automation in chemical analysis: An overview of automated instruments and instrumentation, process control analysis, flow injection analysis, discrete automated systems, automatic analysis based on multilayered films, gas monitoring equipments (6L)	15
UNIT – III: GREEN CHEMISTRY 3.1 Principle and concepts of green chemistry: Sustainable development and green chemistry, Atom economy, examples of atom economic and atom uneconomic reactions, reducing toxicity (4L) 3.2 Organic solvents: environmentally benign solutions, solvent free systems, supercritical fluids (only introduction) Ionic liquids as catalysts and solvents (4L) 3.3 Emerging green technologies, photochemical reactions (advantages and Challenges) examples, Chemistry using microwaves, sonochemistry, electrochemical synthesis (4L) 3.4 Designing Greener processes: Inherently safer designs (ISD), Process intensification (PI) in-process monitoring. (3L)	15

UNIT – IV:ADVANCED TECHNIQUES 4.1 Electrophoresis: 4.1.1 Zone electrophoresis: Factors affecting migration rate, Supporting media (gel, paper, cellulose, acetate, starch, polyacrylamide, agarose, sephedax and thin layers) (4L) 4.1.2 Techniques of electrophoresis: Low and high voltage, SDS-PAGE, iso electric focusing, continuous electrophoresis, capillary electrophoresis, Zone, gel, isoelectric focusing, isotaechophoresis and miceller electro kinetic capillary chromatography, instrumentation, detection and applications (6L) 4.2 Introduction to Nanotechnology: Analytical techniques in nanotechnology, consequences of the nano scale, (nano particles morphology, electronic structure, optical properties) one dimensional nano materials (nano films , nano layers) Two dimensional nano materials (nano tubes, nano wires) three dimensional nano materials (nano Particles and quantum dots) (5L)	15

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1. Quality in the analytical chemistry laboratory, E Prichard, John Wiley and sons N.Y 1997.
2. Quality assurance in analytical, W Funk, V Dammann, G. Donnevert VCH Weinheim 1995.
3. Chemical methods of separation, J A Dean, Van Nostrand Reinhold, 1969
4. Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969.
5. Extraction Chromatography T. Braun, G. Ghersene, Elsevier Publications 1978.
6. Super critical fluid extraction Larry Taylor Wiley publishers N.Y. 1996
7. Ion exchange separation in analytical chemistry O Samuelson John Wiley 2nd ed 1963
8. Ion exchange chromatography Ed H.F Walton Howden, Hutchenson and Rossing 1976
9. Chromatographic and electrophoresis techniques I Smith Menemann Interscience 1960
10. Green chemistry and catalyst, R. A. Sheldon, Isabella Arends, Ulf Hanefeld Wiley VCH verlag GmBH & co.
11. Sustainable residential development: planning and design for green neighborhoods. Avi Friedman, McGraw Hill professional.

PSCHA402

ADVANCE INSTRUMENTAL TECHNIQUES

UNIT-I : SPECTRAL METHODS - III 1.1 Infra red spectroscopy: Recapitulation-Correlation of IR Spectra with molecular structure-Near IR, Far IR AND Mid IR regions, Qualitative Analysis-Group frequencies and Finger print region.(8L) 1.2 NMR: Basic principle, precession of nuclei in a field, FTNMR, Environmental effects on NMR spectra (chemical shift, spin-spin coupling) Applications of C13, P 31 to structure determination, 2 DFTNMR. (7L)	15
UNIT-II: SPECTRAL METHODS - IV 2.1 Mass spectroscopy: Recapitulation, Correlation of Mass spectra with molecular structure, molecular identification, metastable peaks. (8L) 2.2 Raman spectroscopy: Theory, Mechanism of Raman and Rayleigh Scattering, Instrumentation, Applications. Resonance and Surface enhanced Raman Spectroscopy (7L)	15
UNIT - III: RADIOCHEMICAL AND THERMAL METHODS 3.1 Isotope dilution method and activation analysis ,radiometric and radio-release methods Auto,Xray and gamma radiography (7L) 3.2 Principle, Instrumentation and applications of: (8L) 3.2.1 Differential Thermal Analysis 3.2.2 Differential Scanning Calorimetry 3.2.3 Thermometric titrations 3.2.4 Evolved gas analysis	15
UNIT IV: HYPHENATED TECHNIQUES : 4.1 Need for hyphenation, Interfacing devices and applications of GC - MS, GC - IR, MS-MS, HPLC - MS, ICP -MS, ICP - OES.	15

List of books and references:

1. Analytical Chemistry, G. D. Christian, 4 th Ed. John Wiley, New York (1986)
2. Fundamentals of Analytical Chemistry, D. A. Skoog and D. M. West and F. J .Holler Holt-Saunders 6th Edition (1992)
3. Principles of Instrumental Analysis, D. A. Skoog, F. J. Holler and J.A. Niemann 5th Edition (1998)
4. Instrumental methods of Analysis, H. H. Willard, L. L. Merritt, Jr J. A. Dean and F. A. Settle Jr 6th Ed CBS (1986)
5. Instrumental methods of Analysis, H. H. Willard, L. L. Merritt Jr, J. A. Dean and F. A. Settle Jr 7th Ed CBS (1986)
6. Thermal methods of Analysis, P. J. Haines, Blackie Academic & Professional, London (1995)
8. Thermal Analysis, 3rd Edition W. W. Wendlandt, John Wiley, N.Y. (1986)
9. Principles and Practices of X-ray spectrometric Analysis, 2nd Ed E. P. Bertain, Plenum Press , NY, (1975)
10. Nuclear Analytical Chemistry, D. Bane, B. Forkman, B. Persson, Chartwell - Bratt Ltd (1984)
11. Substoichiometry in Radiochemical Analysis, J. Ruticka and J. Stary , Pargamon
12. Radioisotope Techniques, Overman and Clark,, McGraw Hill Book Co. INC New York, (1960)j
13. Standard Methods of Chemical Analysis , Eds. F. J. Welcher, Robert E. Krieger Publishing Company, A series of volumes

PSCHA403

ENVIRONMENTAL AND CERTAIN INDUSTRIALLY IMPORTATNT MATERIAL

UNIT – I: POTABLE WATER -II 1.1 Source, Classification, Pollutants and permissible limits.(2L) 1.2 Effluent treatment plant general construction and process flow charts(2L) 1.3 Treatment and disposal of Sewage.(2L) 1.4. Effluent parameters for metallurgical industry.(2L) 1.5 Permissible limits for metal (example Cr, As, Pb, Cd etc) traces in the effluent.(2L) 1.6 Recovery of metals from effluent, modern methods – Electrodialysis, Electrodeposition, Ion Exchange etc.(3L) 1.7 Recycle and reuse of process and treated (effluent) water(2L)	15
UNIT – II: SOLID WASTE MANAGEMENT 2.1 Source, Classification of Pollutants.(1L) 2.2 Direct and indirect Effects(2L) 2.3 Solid waste management: objectives, concept of recycle, reuse and recovery (3L) 2.4 Methods of solid waste disposal.(2L) 2.5 Treatment and disposal of sludge / dry cake(2L) 2.6 Managing non decomposable solid wastes(2L) 2.7 Classification of bio- medical waste(2L) 2.8 Methods of disposal of bio medical waste(2L)	15
UNIT – III: PLASTICS AND POLYMERS 3.1 Classification of plastic, Determination of additives, molecular weight distribution and fractionation of plastic, analysis of plastic and polymers based on styrene, vinyl chloride, ethylene, acrylic and cellulosic plastics.(5L)	15

3.2 Metallic impurities in plastic and their determination, (2L) 3.3 Determination of Impact of plastic on environment as pollutant.(2L) 3.4 Paints and pigments: Types of paints pigments, determination of volatile and non - volatile components, Flash point (significance and method of determination), separation and analysis of pigments, binders and thinners.(3L) 3.5 Role of Organo silicones in paints and their impact on environment.(3L)	
UNIT – IV: METALLURGY 4.1 Ores and minerals, dressing of ore, methods of metal dressing (hand picking, magnetic separation, centrifuge, froth flotation Etc), pollution due to metallurgical process (Metal dressing, calcinations, smelting) (3L) 4.2 Chemical analysis of Ores: Galena, Pyrolusite, Bauxite, Malachite green, hematite, Monazite (4L) 4.3 Alloys: definition, analysis of cupronickel, magnelium, steel and stainless steel, bronze, gun metal.(4L) 4.4 Alloying: definition, purposeful development of alloy, Carat of Gold (precious material) and its method of analysis. (2L) 4.5 Techniques of purification: Zone refining, analysis of high purity materials like silicon, vacuum fusion and extraction techniques.(2L)	15

List of books and References:

1. Environmental Pollution Analysis, S. M. khopkar, New Age International publication (2011).
2. Water and water pollution (hand book) Ed., Seonard'l Ciacere, Vol I to IV, Marcel Dekker inc. N.Y.(1972)
3. Water pollution, Arvind kumar, APH publishing (2004)
4. Introduction to Potable Water Treatment Processes Simon Parsons, Bruce Jefferson, Paperback publication.
5. Guidelines for drinking-water quality, third edition, (incorporating first and second addenda). WHO report.
6. Solid waste management, K Sasikumar and Sanoop Gopi Krishna PHI publication (2009)
7. Solid waste management, Surendrakumar Northen Book Center (2009)
8. Handbook of chemical technology and pollution control 3rd Edn Martin Hocking AP Publication (2005).
9. Fundamental Concepts of Environmental Chemistry, Second Edition G. S. Sodhi , Alpha Science, 2005
10. Chemical analysis of metals ; Sampling and analysis of metal bearing ores: American Society for Testing and Materials 1980 - Technology & Engineering
11. Manual of Procedures for Chemical and Instrumental Analysis of Ores, Minerals, and Ore Dressing Products. Government of India Ministry of Steel & Mines, Indian Bureau of Mines, 1979.
12. Alloying: understanding the basics, edited by Joseph R. Davis, ASM International (2001).
13. Zone refining and allied techniques, Norman L. Parr, G. Newnes Technology & Engineering (1960).

PSCHA404

Pharmaceutical, Biochemical and organic analysis

UNIT I: PHARMACEUTICAL ANALYSIS : 1.1 General idea regarding pharmaceutical industry. Definition and classification of drugs, introduction to pharmaceutical formulations, classification of dosage forms (6L) 1.2 Sources of impurities in pharmaceutical chemicals and raw materials. (5L) 1.3. Standardization of finished products and their characteristics, official methods of Quality control. (4L)	15
UNIT II: DRUGS 2.1 Analysis of compounds based on functional groups, instrumental methods for analysis of drugs, assays involving chromatographic separations, proximate assays, assays of enzyme containing substances, biological and microbiological assays and tests. 2.2 Limit tests, solubility tests, disintegration tests, stability studies, impurity profile of drugs, bioequivalence and bioavailability studies.	15
UNIT III: FORENSIC SCIENCE AND COSMETICS : 3.1 Analytical Chemistry in Forensic science : General idea 3.2 Biological Analysis: Analysis of biological stains and materials including blood, semen and saliva (qualitative and quantitative). 3.3 Analytical toxicology: isolation, identification and determination of the following : 3.3.1 Narcotics : Heroin, morphine and cocaine 3.3.2 Stimulants: amphetamines, cocaine and caffeine. 3.3.3 Depressants : benzodiazepines, Barbiturates and mandrax 3.3.4 Hallucinogens : LSD and Cannabis 3.3.5 Metabolites of Drugs in Blood and urine of addicts 3.3.6 Viscera, stomach wash, vomit and postmortem blood for poisons like cyanide, arsenic, mercury, insecticides and pesticides.	15

UNIT IV: COSMETIC ANALYSIS: 4.1 Cosmetics: Introduction, Evaluation of cosmetic material and raw material and additives. Fromulation, standards and methods of analysis. (4L) 4.2 Deodorants and antiperspirants : Al, Zn, Zr, Boric acid, chlorides, sulphates, hexachlorophene, methanamine, phenolsulphonates and urea.(3L) 4.3 Face powder : Fats, fatty acids, boric acid, Ca, Mg, $BaSO_4$, Ti, Fe, oxides of Tl, Fe and Al (total). (2L) 4.4 Hair tonic: 2,5-diaminotoluene, potassium bromates, sodium perborate, pyrogallol, resorcinol, salicylic acid, dithioglycollic acid (in permanent wavers) (2L) 4.5 Creams and lotions : types of emulsions, chloroform soluble material, glycerol, pH emulsion, ash analysis, non volatile matter by IR spectroscopy. (2L) 4.6 Lipsticks: General analysis, determination of nonvolatile matter, ash analysis determination of lakes and fillers, trichloroethylene – acetone soluble contents. (2L)	15

List of books and References:

1. Analytical Biochemistry, D, J. Homes and H. Peck, Longman (1983)
2. Bioanalytical Chemistry, S. R. Mikkelesen and E. Corton, John Wiley and sons 2004
3. Analysis of food and beverages, George Charalanbous, Accademic press 1978.
4. Harry's Cosmetology, Longman scientific co.
5. Formulation and Function of cosmetics, Sa Jellineck.
6. Cosmetic Technology, Saggarin
7. Modern cosmetics, E. Thomessen Wiley Inter science
8. Encyclopaedia of industrial chemical analysis, snell et al Inter science
9. Govt of India publications of food drug cosmetic act and rules.
10. Hand book of drug law, Mehta Univ. Book agency Ahmedabad
11. Chemical analysis of drugs, Higuchi, Interscience 1995
12. Connors Text book of pharmaceuticals Analysis, J wiley 2001

Practical course

PSCHA4P1

Group – A: Instrumental Analysis

1. Determination of pK value of H_3PO_4 potentimetrically
2. Estimation of Na^+ in dairy whitener by flame photometry
3. Separation and Estimation of Co^{2+} and Ni^{2+} on anion exchange resin
4. Spectrophotometric determination of pH of buffer solution.
5. Simultanious determination of Ti^{3+} and V^{5+} spectrophotometrically by H_2O_2 method
6. Determination of moisture in the given sample by Karl Fischer method
7. Analysis of mixture of alcohols by GC (ethanol,n-propanol,n-butanol,n-pentanol,t-butanol)
8. Determination of number of theoretical plates of a C18 column

PSCHA4P2

Group – B: Analysis of medicinals , Biochemical, Detergents and Organic compounds.

1. Analysis of drugs by non aqueous titration: Glycine , Sodium Benzoate, Sulphamethoxazole.
2. Analysis of detergents : Active detergent matter, alkalinity and Oxygen releasing capacity
3. Estimation of Vitamin C in ascorbic acid by KBrO3 method
4. Estimation of Fe in Iron tablets using titrimetric method.
5. Estimation of Ca in Ca-pentathonate/calcium lactate tablets
6. Determination of percentage purity of Malachite Green

PSCHA4P3

Group – C: Analysis of Food and oil samples

1. Analysis of Calcium , Iron and phosphorous in milk.
2. Determination of SAP value of oil.
3. Estimation of Aldehyde in lemon oil / Cinnamon oil
4. Estimation of Glucose by Folin-Wu method
5. Canned food : limit tests for Tin / Zinc

PSCHA4P4

Group – D: Metallurgy and water Analysis

1. To analyze Magnelium for Mg titrimetrically.
2. To analyze Bronze for Zn by volumetric method
3. To analyze Steel for: Ni and Cr
4. Analysis of water sample: Cr^{6+} and / or Mn^{2+} by colorimetric method
5. Analysis of Bauxite for Ti by colorimetric / Al by gravimetric / Fe (volumetric

1. The candidate is expected to submit a journal certified by the Head of the Department / institution at the time of the practical examination.
2. A candidate will not be allowed to appear for the practical examination unless he / she produces a certified journal or a certificate from the Head of the institution/department stating that the journal is lost and the candidate has performed the required number of experiments satisfactorily. The list of the experiments performed by the candidate should be attached with such certificate.

Use of non-programmable calculator is allowed both at the theory and the practical examination.

Scheme of examination for M. Sc. Analytical Chemistry Semester III and IV.

Internal Theory examination (40 Marks)

1**.** One seminar based on curriculum / publication of a research paper/ presentation of a research paper in seminar or conference (to be assessed by teacher of the institution teaching PG learners).

A**.** Selection of the topic, introduction, write up, references- **15 marks.**

B. Presentation **15 marks.**

2. Active participation in routine class instructional deliveries. **05 Marks**

3**.** Overall conduct as a responsible learner, communication and leadership qualities in organizing related academic activities. **05 Marks**

There will not be any internal examination for practical.

External Theory Examination (60 Marks)

Paper	Time allotted in hours	Maximum marks
Paper- I	2.5	60
Paper-II	2.5	60
Paper-III	2.5	60
Paper-IV	2.5	60

It is recommended that a total of five questions be set, based on the syllabus with due weightage to the number of lectures allotted per topic. The candidates are expected to answer all five questions. Question 5 will be based on all four units and the remaining questions will be based on the units as indicated below

	Semester- III	Semester-IV
Q.1	Unit-I	Unit-I
Q.2	Unit-II	Unit-II
Q.3	Unit-III	Unit-III
Q.4	Unit-IV	Unit-IV
Q.5	From all four units	From all four units

Semester End Practical Examination (50 Marks)

Laboratory Work	40 Marks
Journal	05 Marks
Viva	05 Marks

Practical

The practical examination will be held for two days as described below. The candidates will be examined practically and orally on each day.

Papers	Day	Experiment	Time duration (hours)	Maximum marks
Paper I	Day -1 M	1	3.5	50
Paper II	Day-1 E	1	3.5	50
Paper III	Day-II M	1	3.5	50
Paper IV	Day-II E	1	3.5	50