

MAHARSHI DAYANAND SARASWATI UNIVERSITY

AJMER

पाठ्यक्रम

SYLLABUS

**SCHEME OF EXAMINATION AND
COURSES OF STUDY**

FACULTY OF SCIENCE

M.Sc. APPLIED CHEMISTRY

M.Sc. SEMESTER-I -2013

M.Sc. SEMESTER-II-2014

M.Sc. SEMESTER-III-2014

M.Sc. SEMESTER-IV-2015

Edition : 2013

Price: Rs-----

महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

M.Sc. Semester Examination

M.Sc. Applied Chemistry

Scheme of Examination

1. The maximum Marks of each year examination will be 600 and 1200 will be total maximum marks for the two years examination. Each year there will be two Semesters of 300 marks each.
2. There will be four papers in each Semester. Each paper will have maximum marks of 50 and of 3 hours duration. There will be one Practical Examination of 6 hours duration with maximum 100 marks.
3. There shall be 16 papers in all (Four papers in each Semester and four Semesters in all). Each theory paper shall be of three hours duration having 50 marks. Out of 50 marks, 20% marks i.e. 10 marks in each paper shall be of internal assessment based on test, seminars and project work in each paper.
4. Scheme of Examination in Individual Semester and distribution of marks in each paper will be as under:

Curriculum & Scheme of Examination for M.Sc Applied Chemistry

Semester Number Total Marks

and Paper Nomenclature

Semester-I

Paper-I	General Chemistry-I	40
Paper-II	General Chemistry-II	40
Paper-III	Spectroscopy-I	40
Paper-IV	Spectroscopy-II	40
Internal Assessment (10 marks for each paper)		40
Paper-V	Practicals	100
		Total =300

Semester-II

Paper-VI	Environmental Chemistry	40
Paper-VII	Computer Programming For Chemists	40
Paper-VIII	Diffraction Methods & Spectroscopy	40
Paper-IX	Catalysis & Enzymes	40
Internal Assessment (10 marks for each paper)		40
Paper-X	Practicals	100
		Total =300

Semester-III

Paper- XI	Polymer Processing & Testing	40
Paper-XII	Principles of Chemical Engineering	40
Paper-XIII	Industrial Chemistry -I	40
Paper-XIV	Industrial Chemistry -II	40
Internal Assessment (10 marks for each paper)		40
Paper-XV	Practicals	100
		Total =300

Semester-IV

Paper-XVI	Pharmaceutical Chemistry	40
Paper- XVII	Separation Techniques	40
Paper- XVIII	Analytical Methods	40
Paper-XIX	Chemical Analysis	40
Internal Assessment (10 marks for each paper)		40
Paper-XX	Practicals	100
		Total =300

Grand Total = 1200

M.Sc. Applied Chemistry Semester- I Examination

PAPER- I GENERAL CHEMISTRY-I

Duration: 3 hours Maximum Marks: 40

Note: - The paper is divided into three independent units. The question paper is divided into three Parts - Part A, Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Electrochemical Phenomenon and Quantum Mechanics

Redox Systems, electrochemical cells and electrochemical reactions, electrochemical series, Hydrogen electrode.

Primary batteries and Secondary cells, cell characteristic and cell capacity, types of plates and Separators and their significance in lead cells, Batteries for space, Fuel cells, Photovoltaic effect of light solar batteries.

Introduction to corrosion, homogeneous theory, forms of corrosion, corrosion monitoring and prevention methods.

Basic Principles of Quantum Mechanics: Postulates, Schrodinger Equation to some model systems viz. harmonic oscillator and hydrogen atom, particle in a box.

Unit-II

Crystal defects and Non-Stoichiometry

Perfect and imperfect crystals, intrinsic and extrinsic defects – point defects, line and plane defects, vacancies-Schottky defects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centers, non-stoichiometry and defects.

Group Theory: Symmetry elements, point groups, character tables, selection rules, applications.

Unit-III

STEREOCHEMISTRY

Molecular dissymmetry and optical activity, properties of enantiomers, diastereoisomers, racemic modifications, resolution, prochirality, stereogenic centre, stereospecificity, stereoselectivity, chemoselectivity, chemospecificity, regioselectivity and regiospecificity, stereoselective synthesis, factors affecting the stabilities of transition states, intermediates and products .

Books Suggested :

- 1.Modern Electrochemistry Vol. I & II (Plenum Publishers):J O M Bockril& A K N Reddy
- 2.Atkin Physical Chemistry(Oxford University Press, New York):Atkin P & Paula J D
- 3.Physical Chemistry(Pergoman Press, Oxford, London): Moelwyn-Hughes E A
- 4.Physical Methods in Chemistry(Saunders College) : RS Drago
5. Essentials of Crystallography :M.A.Wahab Springer 2008
6. Crystallography and Crystal Structure : G. D. Arora: Sarup& Sons, New Delhi 1stEdn. 2000
- 7.Corrosion Engineering:M.G. Fontane& N.D. Green,McGraw Hill Company N.Y.
- 8.Corrosion & Corrosion Control:H.H.Uhlig, John Wiley & Sons Inc
- 9.Advanced Physical Chemistry: Gurtu and Gurtu,PragatiPrakashan
- 10.Solid State Chemistry :V K Selvaraj
11. Stereochemistry by Patapov
12. Stereochemistry by D. Nasipuri

PAPER- II GENERAL CHEMISTRY-II

Duration : 3 hours

Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A, Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Adsorption and Miscelles : Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), BET equation (without derivation) for estimation of surface area, Gibbs adsorption isotherm.

Surface active agents, classification of surface active agents, micellization, thermodynamics of micellization, critical micellar concentration (CMC), factors affecting the CMC of surfactants.

Unit-II

Chemical Thermodynamics and Elements of Statistics

Laws of Thermodynamics, Spontaneity and Equilibria, temperature and pressure dependence of thermodynamic quantities, Le Chatelier Principle, thermodynamics of ideal and non-ideal gases and solutions, partition functions and their relation to thermodynamic quantities

Data Analysis: Mean and Standard deviation, absolute and relative errors, linear regression, correlation coefficient

Unit-III

Analysis of Ores and Alloys.

Sampling and pretreatment of Ores and Alloys, Care of platinum vessels, composition and analysis of Hematite, Pyrolusite, Galena, Ilmenite, Wolframite, chrome ores.

Books Suggested :

1. Analytical Methods for ores and Minerals, ISDN 978-81-89866-54-9/2009, TBA (B.H. Khawas)
2. A Laboratory Manual of Metals and Alloys Vol -II, ISDN 978-81-907462-4-3/2009, (S.M. Ashraf, Sharif Ahmad, UfanaRauaz)
3. Chemical & Instrumental Analysis of Ores Minerals & Ore Dressing Products, IBM Nagpur
4. A Text Book of Physical Chemistry by Samuel Glastone. Pub. Maxmillian Student Editions.
5. Physical Chemistry, Gordon M.Barrod Pub. International Science Edition McGraw Hill
6. A Text Book of Physical Chemistry, Irs N Levis Pub. McGraw Hill Int. Book Co.
7. Physical Chemistry, Gurdep Raj & Chatwal Pub. Goel Pub. Meerut
8. Text Book of Physical Chemistry, Negi & Anand Pub. Wiley E. Ltd.
9. Physical Chemistry, I.N. Levine, 5th Edition (2002), Tata McGraw Hill Pub. Co. Ltd., New Delhi.

PAPER III: SPECTROSCOPY-I

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Atomic Spectroscopy

Energies of atomic orbitals, term symbols and L-S and J-J Coupling, spectra of hydrogen atom and alkali metal atoms.

Molecular Spectroscopy

Molecular orbitals and its energy levels, Franck Condon Principle, electronicspectra of diatomic and polyatomic molecules, Paschen-Back effect, Zeemaneffect, Spectra of transition metal complexes, charge transfer spectra.

Unit-II

Infrared Spectroscopy

Review of linear harmonic oscillator, vibrational energies of diatomicmolecules, zero point energy, force constant and bond strengths, vibrations of polyatomic molecules.Selection rules, normal modes of vibrations, group frequencies, overtones,hot bands, factors affecting the band positions and intensities,2DNMR(COSY,HETCOR,NOESY,DEPT,APT,NEPT)

Unit-III

Nuclear Magnetic Resonance (NMR) Spectroscopy

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei,chemical shift and its measurements, factors influencing chemical shift,deshielding, spin-spin interactions, factors influencing coupling constant 'J'.Classification (AX,AB, ABX, AMX, ABC, A₂B₂ etc.), spin decoupling, basic ideasabout instrument, Applications of NMR, ¹³CNMR– carbon chemical shift, γ carbon effect, assignment techniques.

Books Suggested:

1. Molecular Spectroscopy : Jag Mohan : Springer 2008
2. Application of Absorption Spectroscopy of Organic Compounds : Dyer : Eastern Economy Editions
3. Inorganic Spectroscopy & Related topics : Frinza Hammer, Sarup& Sons 2008
4. A Handbook of Molecular Spectroscopy, 2005, PoojaBhagwan
5. SpectoscopicIndentification of organic compunds, R.M. Silversterin, C.G. Bassler& T.C. Morrill, John Wiley & Sons N.Y.
6. Fundamentals of Molecular Spectroscopy, G.M. Namme; Mc Craw Hill Company N.Y.1972
7. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Craw Hill Company N.Y. 1972
8. Spectroscopy Vol I & II, S.Walker& H. Stane, Chapman & Hall 1962
9. Principles of Magnetic Resonance, C.P. Shichter, Springer Verlag 1981
10. Molecular spectroscopy, J.D. Graybeal , McGraw hill 1988

11. Fundamental of Molecular Spectroscopy, Colin N Banwell and Elaine, M Mccasn
12. Instrumental Methods of Chemical Analysis by Willard, East West Press Pvy.Ltd.
13. Instrumental Methods of Chemical Analysis by Chatwal&Anand, Himalaya Pub.
14. Instrumental Methods of Chemical Analysis by B.K.Sharma, Goel Pub. House Meerut.
15. Spectroscopy of Organic Compounds by P.S Kalsi New Age International Publisher.

PAPER IV: SPECTROSCOPY-II

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Raman Spectroscopy

Classical and quantum theories of Raman effect, Pure rotational , vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, Coherent Anti Stokes Raman Spectroscopy (CARS).

Elementary idea of principle and applications of Mossbauer Spectroscopy.

Unit-II

Mass Spectrometry

Theory, Instrumental set-up and its mode of operation, mass spectrometers. Process of ionization separation and detection of ions, Mass spectrum and its interpretation determination of molecular formula, weight and structure. Fragmentation, Recognition of molecular ion. General appearance of the mass spectra, Presentation of mass spectra, Meta stable ion, Mass spectra of classes of organic compound. Application of mass spectrometry.

Unit-III

Nuclear Quadrupole Resonance Spectroscopy

Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting. Applications.

Electron Spin Resonance Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, applications.

Books Suggested:

1. Introduction to Mass Spectrometry – J. Robog, John Wiley Inter. Pub
2. Instrumental Methods of Chemical Analysis by Willard, East West Press Pvy.Ltd.
3. Instrumental Methods of Chemical Analysis by Chatwal & Anand, Himalaya Pub.
4. Instrumental Methods of Chemical Analysis by B.K.Sharma, Goel Pub. House Meerut.
5. Spectroscopy of Organic Compounds by P.S Kalsi New Age International Publisher.
6. Organic Chemistry by T.M. Graham Solomons & Craig B. Fryhle, John Wiley & Sons New York
7. Electron Spectroscopy, 2002, (Rajbir Singh)
8. Spectroscopy, H Kaur, Pragati Prakashan

PAPER- V PRACTICAL

Duration: 6Hrs

Max. Marks:100

A. Quantitative analysis of Ore and Alloys (Minimum three)

1. To estimate Ferrous , Ferric individually or both Ferrous and Ferric Iron in the given sample.
2. To determine copper and nickel in the given sample by Iodometry
3. To determine chromium in chromite ore.
4. To estimate calcium in limestone or dolomite.
5. To estimate Manganese Dioxide in pyrolusite
6. To determine percentage of copper in brass.
7. To determine percentage of iron in plain carbon steel.
8. To determine percentage of silver in the given sample.

B. Flame Photometric Determinations (Minimum Three)

1. Sodium in Water or Soil sample.
2. Potassium in Water or Soil sample
3. Calcium in Water or Soil sample
4. Sodium and potassium when present together
5. Lithium in Water sample
6. Barium/ strontium in Water sample
7. Sulphate in Water sample
8. Phosphate in Water sample
9. Silver in Water sample

C. Chromatographic Separations (Minimum Five)

(I) Perform Thin Layer Chromatographic Separation of the following and determine R_f values :

1. Cadmium (II) and Zinc (II) ions
2. Zinc (II) and Magnesium (II) ions
3. Nickel (II), Cobalt (II) and Zinc (II) ions
4. Manganese (II), Cobalt (II) and zinc (II) ions.
5. Silver (I), Lead (II) and Mercury (II) ions
6. Arsenic (III), Antimony(III) and Antimony (II) ions
7. Lithium (I), Sodium(I) and Potassium(I) ions
7. Barium (II), Strontium (II) and Calcium(II) ions
8. Nickel (II), Cobalt (II), Copper (II) and Zinc (II) ions
6. Mercury (II), Copper (II), Lead (II), Bi (II) and Cadmium (II) ions
7. Fluoride , Chloride, Bromide and Iodide Ions

(II) To Separate a mixture of sudan red and sudan yellow by adsorption on silica gel.

(III) To Separate a mixture of methylene blue and fluorescein (sodium salt) on an alumina column

(IV) To Separate a mixture of o- and p- nitroanilines on an alumina column

(V) To study the separation of organic acids by one dimensional paper chromatography

(VI) To separate a mixture of amino acids by Thin Layer Chromatography

(VII) To separate a mixture of monosaccharides by Thin Layer Chromatography

(VIII) To separate a mixture of dyes by thin layer chromatography

(IX) To separate a mixture of components e.g. o- and p- nitroanilines by TLC technique

(X) To determine by Column or TLC Technique whether the following inks consist of single or multiple mixtures of dyes.

(XI) To separate components of chlorophyll by ascending paper chromatography

D. Spectroscopy

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, MASS)

Books Suggested:

1. A textbook of Quantitative Analysis , A.I. Vogel
2. A textbook of Qualitative Analysis , A.I. Vogel
3. Water Analysis, Trivedi and Goel
4. Experiments and Calculations in Engineering Chemistry, S.S. Dara

INSTRUCTIONS FOR PRACTICALS

Maximum Marks: 100

Duration : Six hours

The Board of Examiners will constitute of one External Examiner and one Internal Examiner

Marking Scheme

Exercise	Marks
A. Quantitative analysis	30
B. Flame Photometric Determinations	20
C. Chromatographic Separations	15
D. Spectroscopy	15
E. Record	10
F. Viva	10
Grand Total	100

PAPER-VI ENVIRONMENTAL CHEMISTRY

Duration: 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Water and Water Pollution

Objectives of analysis, parameter for analysis-colour, temperature, transparency, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, hydrogen sulphide, Fe, Na, K, phosphorus (Total, inorganic, organic), carbohydrate (Total, dissolved, particulate) and different forms of nitrogen, DO, BOD, COD, free CO₂. Purification and Waste Water Treatment (Primary, Secondary and Tertiary Treatment Processes)

Sources of water pollution- solid waste, industrial, agricultural, oil, radioactive waste, pesticides , thermal pollution, classification of water pollutants and their effects , sampling of water pollutants. Heavy metal pollution in water - cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic pollution and their analysis

Unit-II

Air and Air Pollution

Important Chemical and photochemical reactions in atmosphere. Greenhouse effect, acid rain, ozone hole phenomenon, thermal inversion.

Air quality standards, sampling of air pollutants- gaseous and particulate, analysis of air pollutants, stack monitoring. Sources- stationary and transportation sources of air pollution, classification of air pollutants- sources, effects and control of CO, SO₂, NO_x , HC as gaseous pollutants, suspended particulate matter aerosols, photochemical air pollution. Source and toxic effects of Pb, Cd, Hg, As, Cr, Ni and Mn.

Unit-III

Soil and Soil Pollution

Definition, components of soil, fertility management of soils, soil sediment analysis-physical and chemical parameters.

Soil pollution- sources, detrimental effects and control.

Analysis of soil: moisture, pH, total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts.

Books Suggested:

1. A Laboratory Manual for -Environmental Chemistry, ISBN 978-81-907462-5-0/ 2009, R. Gopalan, Amirtha Anand, R. Widfred Sugumar
2. Standard Method of Chemical Analysis Vol I & II, Hultcher
3. Environmental analysis & instrumentation, Rajvidya Markomdey
4. Experiments in Environmental Chemistry, Sayta Prakash Mohan, Sushu Chauhan
5. Environmental Chemistry by A.K. De Willey Esterh Ltd.
6. Environmental Chemistry by S.E. Manahan, Willgrd grant Press.
7. Environment chemistry by B.K.Sharma & Miss H. Kaur
8. Chemistry and Biological Method for water Pollution studies by Goel & Trivedi Env Pub
9. Environmental Chemistry (Lewis Publishers), Se Mannahan
10. Environmental Chemistry (Wiley Eastern), A. K. Dey
11. Air Pollution : V.P. Kudesia: Pragati Prakashan, Meerut.
12. Water Pollution : V.P. Kudesia & R. Kudesia: Pragati Prakashan Meerut.
13. Industrial Pollution : V.P. Kudesia: Pragati Prakashan Meerut.
14. Soil Testing and Analysis: Plant, Water and Pesticide Residues Pant ram, 2007, ISBN 8189422707

15. A Laboratory Manual for -Environmental Chemistry, ISDN 978-81-907462-5-0/ 2009, R. Gopalan, AmirthaAnand, R. WidfredSugumar
16. Principles and Practices of Air Pollution and Control, ISDN 978-93-80026-38-1/2009, TBA(J.R. MudaKavi)
17. The Chemistry of our environment , R.A. Horse, Wiley inter Science 1978
18. Environmental Chemistry of soils , Murray BMC, Oxford University Press 1994
19. Environmental Chemistry , H Kaur, PragatiPrakashan
20. Environmental Chemistry , M S Sethi , Shri SaiPrintographers
21. Soil Chemical Analysis , M.L. Jackson
22. Soil Chemical Analysis, Piper , Elsevier's Publication

PAPER- VII COMPUTER PROGRAMMING FOR CHEMISTS

Duration : 3 hours Maximum Marks : 40

Note :-The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Introduction to Computers and Computing

Basic structure and functioning of computers with a PC as an illustrative example. Memory, I/O devices. Secondary storage. Computer language. Number System binary, octal, hexadecimal and their interconversions, memory management. Operating systems with DOS as an example. Introduction to UNIX and WINDOWS, MS Office, Data Processing, principles of programming. Algorithms and flow-charts.

Introduction to Networking

- (a) Introduction – Server, client and parts, server and network operating system, network cards, cabling and hubs, maintenance and connecting to internet.
- (b) Features and concepts of e-mail technology – Message headers, Addressbook, Attachment, Filtering and forwarding mails.
- (c) Web Technology – languages and protocols, web page and website, scientific websites. Web resources – search engines, message boards, web page creation concept – planning navigation.

Unit-II

Computer Programming in C

Overview of C, Constants, Variables, and Data Types, Operators and Expression, Managing Input and Output Operators, Decision Making and Branching, Single and two dimensional arrays, structure, IF statement, IF....ELSE statement, GO TO statement, Decision Making and Looping, WHILE statement, DO statement and FOR statement, Jumps in loop.

Unit-III

Programming in Chemistry

Development of small computer codes involving simple formulae in chemistry, such as Vander Waals equation, titration, kinetics, radioactive decay. Evaluation of lattice energy and ionic radii from experimental data. Linear simultaneous equations to solve secular equations within the Huckel theory. Elementary structural features such as bond lengths.

Books Suggested:

1. Computer and their application to chemistry : R. Kumari: Springer 2008
2. Computer of Chemists, Pundir&Bansal ,PragatiPrakashan
3. Computer and Common Sense, R. Hunt and J. Shelley, Prentice Hall
4. Computational Chemistry, A.C. Norris.
5. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger.
6. Computer Programming in Fortran IV, V. Rajaraman, Prentice Hall.
7. An Introduction to Digital Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall

Paper –VIIDIFFRACTION METHODS & SPECTROSCOPY

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Diffraction Methods

X-ray Diffraction

Bragg condition, Miller indices, Laue methods, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystal, index reflections, identification of unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramchandran diagram.

Electron Diffraction

Scattering intensity v/s scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules, Low energy electron diffraction and structure of surfaces.

Neutron diffraction

Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.

Unit-II

Microwave Spectroscopy

Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.

Atomic Absorption Spectroscopy :

Principles, Instrumentation set-up and analytical procedure of absorption spectroscopy. Precision and accuracy of atomic absorption spectroscopy. Relation between atomic absorption and flame emission spectroscopy. Applications : Qualitative , Quantitative and Analytical .

Unit III

Photoelectron Spectroscopy

Basic principles, photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, Electron Spectroscopy for Chemical Analysis (ESCA), chemical information from ESCA. Basic Idea of Auger Electron Spectroscopy.

Photoacoustic Spectroscopy

Basic principles of photo acoustic spectroscopy (PAS), PAS-gases and condensed systems, chemical and surface applications.

Books Suggested:

1. Basic of X-Ray Diffraction and its application, ISBN 978-81-89866-07-5/2007 (K. Ramakanth Hebbar)
2. Solid state chemistry 2009 , Kumar. J., Rajputana Book House, Ajmer
3. Solid State Chemistry, D K Chakarbarty , New age International Publishers

PAPER-IX CATALYSTS AND ENZYMES

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Catalysts—Introduction, classification, types , actions, catalytic action of enzymes, industrial catalysis. Metal ion catalysis, Spectral and Magnetic properties of transition and inner transition elements, industrial importance of their compounds as catalysts, catalysts for refining and petrochemical industries.

Unit-II

Enzymes and their Biotechnical Applications

Properties of enzymes like catalytic power, specificity and regulation. Uses of Metalloenzymes (Carbonic anhydrase, Carboxypeptidase)

Large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes and their applications, use of enzymes in food industry, brewing and cheese making, high fructose corn syrup, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Unit –III

Electronic Properties and Band Theory

Electronic structure of solids-band theory, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.

Optical properties- Optical reflectance, photoconduction.

Magnetic Properties- Classification of material, quantum theory of paramagnetic cooperative phenomena-magnetic domains, hysteresis.

Books Suggested:

1. Bioorganic Chemistry: A Chemical Approach to Enzyme Action
(SpringerVerlag): HeermanDugas and C Penny
- 2.Understanding Enzymes (Prentice Hall) , Trevor Palmer
- 3.Biochemistry: The Chemical Reactions of living cells (Academic Press) ,De Metzler
- 4.Catalysis, concept and green applications :Gadi Rothenberg : Cambridge University Press
- 5.Understanding Enzyme : Trevor Palmer: Prentice Hall
- 6.Enzyme Chemistry : Impact & Applications : Ed. Collin J Suckling, Chapaman and Hall.
- 7.Fundamental of Enzymology : N.C. Price and L. Stevens : Oxford University Press : 3rdedn 2006
8. Immobilized Enzymes : An introduction and Application in Biotechnology : Michael D. Trevan, John Wiley.
9. Enzyme Structure and Mechanism : A Fersht, W.H. Freeman.
- 10.Homogeneous catalysis , G.W. Persons, John wiley N.Y. 1990
- 11.Principles & application of Homogeneous catalysis, A. Kira Nakamura Minoru Tstsui, John Wiley N.Y. 1980
- 12.Introduction to the principles of Homogenous catalysis , J.M. Thomas & W.J. Thomas, Academic Press London 1967
- 13.Biology of Chemists, Dr P K Agarwal, PragatiPrakashan
- 14.Biochemistry, John K Joseph
- 15.Enzymes , S. K Singh

PAPER- X PRACTICAL

Duration: 6Hrs

Maximum Marks:100

A. Analysis of water(Minimum ten)

Examine the physical characteristics of the sample of water supplied and determine the following characteristics.

- (i) Alkalinity to Phenolphthalein and methyl orange.
- (ii) Total Hardness.
- (iii) CalciumHardness
- (iv) Chloride
- (v) Dissolved Oxygen
- (vi) Sulphate
- (vii) Resident Chlorine.
- (viii) Total dissolved solids

- (ix) Conductivity
- (x) Biological Oxygen Demand
- (xi) Chemical Oxygen Demand
- (xii) Acidity or pH
- (xiii) Ammonia Nitrogen
- (xiv) Nitrite Nitrogen
- (xv) Nitrate Nitrogen
- (xvi) Silicon
- (xvii) Phosphorus
- (xviii) Fluoride
- (xviii) Iron by Colorimetry
- (xix) Determine the available chlorine content of bleaching powder extract supplied with the solution of thiosulphate against standard dichromate solution.
- (xx) Discuss the physical and chemical characteristics of water you have examined and comment on the suitability of water for drinking industrial purpose.
- (xxi) Determine the physico-chemical parameters of soil .

B. Preparations and Isolations (Minimum five)

1. Preparation of Indigo
2. Preparation of Methyl Orange
3. Isolation of Caffeine from tea leaves.
4. Isolation of Casein from milk
5. Isolation of Mucic Acid from milk
6. Isolation of Nicotine from tobacco.
7. Isolation of piperine from black pepper.
8. Isolation of carotene from Carrot
9. Isolation of lactose from milk
10. Isolation of eugenol from cloves
11. Isolation of (+) limonene from citrus rind
12. Isolation of Cystine from human hair
13. Isolation of D(+) Glucose from cane-sugar
14. Isolation of Hippuric Acid from Urine.

Books suggested:

1. Advanced Practical Chemistry, Jagdamba Singh ,Pragati Prakashan
2. Experiments and Calculations in Engineering Chemistry, S.S.Dara

INSTRUCTIONS FOR PRACTICALS

Maximum Marks: 100

Duration : Six hours

The Board of Examiners will constitute of one External Examiner and one Internal Examiner

Marking Scheme

Exercise	Marks
A. Water analysis(Two Exercise)	40 (20 each)
B. Preparation and Isolation(Two exercise)	40(20 each)
C. Record	10
D. Viva	10
Grand Total	100

M.Sc Applied Chemistry Semester-III Examination

PAPER- XI POLYMER PROCESSING & TESTING

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A, Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Polymer Processing

Plastics, elastomers and fibres. Compounding, Processing techniques: calendaring, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

Structure and Properties of polymer

Order in crystalline polymers-configurations of polymer chains. Crystal structure of polymers, crystallization and melting. Polymer structure and physical properties-crystalline melting point- melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Relationship between T_m and T_g , effects on molecular weight.

Unit-II

Analysis of Polymers

Polydispersion-average molecular weight concept. Number, weight and viscosity, average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.

Analysis and testing of polymers-chemical analysis of polymers, spectroscopic methods, X-ray diffraction study, Microscopy. Thermal analysis and physical testing-tensile strength. Fatigue impact. Tear resistance. Hardness and abrasion resistance.

UNIT –III

Commercial Polymers

Preparation , properties and uses of Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins,epoxy resins and silicone polymers.

New polymers- Fire retarding polymers,liquid crystal polymers and electrically conducting polymers. Biomedicalpolymers.

Books Suggested :

1. Liquid Crystals and Polymers :G. D. Arora: Sarup& Sons, New Delhi 1stEdn. 2005
2. Principles of Polymerization, George OdeaoIIled, John Wiley & Cons.
3. Principles of Polymer Chemistry, A. Rawe 1995
4. Principles of Polymer Systems, Ferdinand Rodriguez IV thed, Taylor & Francis
5. Experiment in Polymer Science, D G Hundiwale, New age international Publishers
6. Advance and polymer science, J P Knneddy, S Nagg, D Hunkeler
7. Advance polymer Chemistry, Dr V K Selvaraj
8. Laboratory Manual of Polymers Vol-I, ISDN 978-81-90746-23-6/2009. S.M. Ashraf, Sharif Ahmad, UfanaRauaz
9. A Handbook of Polymer Chemistry, 2005 , Dinesh Sharma
- 10.Text Book of Polymer science , Fred W. BillmeyerJr
- 11.Principles of Polymer Chemistry , A Ravve
12. Polymer Chemistry, V. Gawrikor

PAPER- XII PRINCIPLES OF CHEMICALENGINEERING

Duration: 3 hours Maximum Marks: 40

Note :- The paper is divided into three independent units. The question paperis divided into three Parts - Part A , Part B and Part C. Part A (8 marks) iscompulsory

and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Basic Concept of Unit Operations and Unit Process. Unit Processes and unit operations with equipments, characteristics of unit processes, process instrumentation. Good laboratory Processes, Safety hazards in chemical laboratory.

Mass transfer: Different modes of mass transfer, concentrations, various velocities and fluxes, Ficks law of diffusion.

Unit-II

Definition of Thermodynamic Laws and application of thermodynamics in unit process, combustion reaction, Theoretical Air, Excess air, Air Fuel ratio, analysis of products of combustion. Internal energy and enthalpy of reaction, heating value of fuels, enthalpy of formation, adiabatic flame temperature, entropy changes for reactive mixtures.

Unit-III

Chemical Process Kinetics: Types of chemical reactions, catalytic rate equations. Adsorption-equations, factors affecting a chemical process. Reactor shape and effect of back mixing on products distribution. Selection and sizing of Homogeneous and catalytic reactor.

Books Suggested:

1. Process Heat Transfer: S.K. Das: Springer 2008
2. Comprehensive Engineering Chemistry, ISDN 98-81-89866-55-6/2007, (Devender Singh, Balraj Deshwal, Satish Kumar Vats)
3. Modeling and Analysis of Chemical Engineering Processes, ISDN 978-81-89866-31-0/2007, (K. Balu, K. Padmanabhan)
4. Problems on Material and Energy Balance Calculation, ISDN 978-93-80026-04-06/2009 (K. Balu, N. Satyamurthi, S. Ramalingam, B. Deepika)

5. Process Central Instrumentation, ISBN 978-93-80026-39-8/2009, TBA (P.Sai Krishna)
6. Fundamentals of Fluid Mechanics, ISBN 978-81-89866-67-9/2008, (G.S. Swahney)
7. Material Sciences for Engineers, ISBN TBA/2009, TBA (Kishore T. Kashyap)
8. Principles of industrial Chemistry, Chries A Clansmen III, Mattsen J Wiley Inter Science
9. A text book of Chemical Technology Vol II, S.D. Shukla and G.N. Pandey
10. Wellman's encyclopedia of Industrial Chemistry, Arpe et al, Editorial Advisory Board
11. Industrial Organic Chemistry, K Weissner/H J arpe
12. Engineering Chemistry, Jain & Jain, Dhanpatrai and Sons
13. Engineering Chemistry, S P Bakshi, CBS Publishers and Distributors
14. Unit Processes in organic synthesis, P H Gorring, Tata M C Graw Hill Publishing Company Ltd
15. Concepts of Chemical Engineering, SS. Dara

PAPER- XIII INDUSTRIAL CHEMISTRY-I

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A, Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Glass Industry: Introduction, classification of glass, basic raw materials of glass, manufacturing processes including chemical reactions, some special glasses: optical

glass, coloured glass, fibre glass, laminate glass, safety glass, photosensitive glass, photochromatic glass, lead glass, borosilicate glass and glass wool.

Ceramics (Clay and clay products):-

Formation classification, composition and plasticity of clay and clay products, Efflorescence on bricks. Terracotta ware. Pottery porcelain, other clay products sanitary wares, porcelain insulators their chemistry and compositions.

Unit-II

Cement Industry: Types of cement, manufacture of Portland cement, composition, setting and hardening of cement, Mortars and concrete, gypsum, plaster of paris, estimation of silica, alumina, calcium oxide and sulphates in Portland cement.

Oils, Fats, Soaps: -

Introduction of oils fats and soaps, Chemistry of extraction, refining and bleaching of oil. Manufacture of soybean and cotton seed oils. Extraction of essential oils. Physical & chemical properties and tests of oils, fats and soaps. Manufacture of anionic, cationic, nonionic & ampholytic surfactants production of difference types of soap.

Unit-III

Synthetic dyes and Nitrogen, Phosphorus, Potassium (NPK) fertilizers :-

Unit process for manufacture of dyestuff-intermediates, General classification of synthetic dyes. Brief ideas of preparation, properties and uses of the nitro, nitroso, azo, triphenyl methane, xanthene and Phthalocyanin dyes.

Classification and role of fertilizers, Manufacture and uses of Urea, Ammonium Sulphate, Ammonium Nitrate, Single Super Phosphate, Triple Super Phosphate, Potassium Chloride and Potassium Sulphate fertilizers, Biofertilizers

Books Suggested:

1. Thermal Engineering Data Handbook, ISBN 978-81-89866-32-7/2007, B. Sreenivasa Reddy, K Hemachandra Reddy

2. Industrial Hygiene and Chemical Safety, ISDN 978/81-888237-92-0, (M.H. Fulekar)
3. Industrial Chemistry, J S Jangwal & A S Mathuria
4. Industrial Chemistry, B K Sharma, Goel Publishing House Meerut
5. Industrial Chemistry, Reigel, Reinhold Publishing Co.

PAPER- XIV INDUSTRIAL CHEMISTRY -II

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A, Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Pulp, Paper and Textile technology: -

Introduction. Raw material, wood chemistry. Chemistry of pulping & bleaching. Manufacture of rayon and paper pulp. Production of kraft, writing & printing paper (Paper making). Recovery of chemical from spent liquors. Physical & Chemical test of pulp and paper. Natural and Synthetic fibers & textile fiber. Manufacture of viscous rayon fiber, cellulose acetate fiber, acrylic fiber.

Unit-II

Fermentation and Sugar Technology: -

Introduction. Fermentation. Equipment. Media preparation. Growth phase & Enzyme, Functions, Account of Some Fermentation processes. Manufacture of Alcoholic beverages, Manufacture of Vinegar, Lactic Acid, Citric Acid.

Introduction of sugar technology. Manufacture of Cane Sugar, recovery of sucrose from molasses preparation of Celotex, Physico chemical properties and testing of Sugar and its intermediate. Sugar industry in India.

Enamels:-

Definition types of enamels and description of enamels. Manufacturing processes of lacquers, paint enamels, pyroxylin, vitreous enamels.

Unit-III

Petroleum and its products:-

Composition of petroleum, natural gas, petroleum distillation, methods of separation of products, Crystallization, Super fractionation, Azeotropic and extractive distillation study of cooling tower, cracking processes, Lubrication oil refining hydrogen processing of petroleum petro-chemical industry, Alkylation of paraffin-acid, Catalytic refining, solvent refining.

General characteristics of petroleum hydrocarbons viz. Alkanes, Alkenes, Alicyclics, Aromatics. Preparations of gaseous hydrocarbons, separation of liquid hydrocarbons.

Books suggested:

1. Principles of industrial Chemistry, Chries A Clansmen III, Mattsen J Wiley Inter Science
2. A text book of Chemical Technology Vol II, S.D. Shukla and G.N. Pandey
3. Wellman's encyclopedia of Industrial Chemistry, Arpe et al, Editorial Advisory Board
4. Pulp and Paper Chemistry & Chemical Technology – Vol. I, II, III by Jones P Carey

PAPER- XV PRACTICAL

Duration: 6Hrs.

Max. Marks:100

A. Analysis of cement (Minimum three):

1. Loss on ignition
2. Silica
3. Fe_2O_3
4. Combined Fe_2O_3 and Al_2O_3
5. Calcium
6. Magnesium
7. Sodium
8. Potassium

B. Analysis of polymers (Minimum three)

1. Determine Acid Number of Resin/Plastic material.
2. Determine Saponification value of Plastic material.
3. Determine Iodine value of Resin /Plastic Material.
4. Determine Hydroxyl Value of Plastic material.
5. Determine Carbonyl Value of Resin/ Plastic Material.
6. Determine Amine Value of Resin / Plastic Material
6. Determine Molecular Weight of a polymer.
7. Determine Isocyanate Content of Resin /Plastic Material
8. Determine Epoxy Equivalent and Epoxy Value of Resins/Plastic Material
7. Determine Capacity of Cation exchange resin.
8. Determine Capacity of an Anion exchange resin.
9. Separate Zn and Mg in the given unknown solution by Anion Exchange Resin (Amberlite IRA-400) column followed by their estimation with N/100 EDTA and Eriochrome Black-T as indicator.
10. Separate Ni and Co in the given sample solution by Anion Exchange Column followed by their estimation by back titration using EDTA and xylenol orange as indicator.

C. Preparation of polymers (Minimum three)

1. Prepare Urea Formaldehyde resin.
2. Prepare Phenol Formaldehyde resin.
3. Prepare Nylon- 6, 6Poly (HexamethyleneAdipamide)
4. Prepare Nylon- 6, 6 or Nylon- 6,10 by Interfacial Polymerization
5. Prepare Polyurethane Prepolymer
6. Prepare polystyrene by Suspension or Emulsion or Bulk or Solution Polymerisation.
7. Prepare Polysulphide Rubber
8. Prepare Polyester Resin by Melt Condensation or Solution Condensation Method
9. Prepare Epoxy Resin.

Books Suggested:

- 1.Experiments in Polymer Science, D.G.Hundiware , V.D. Athawale
New Age International Publishers
- 2..Advanced Practical Chemistry, JagdambaSingh ,PragatiPrakashan
- 3.Experiments and Calculations in Engineering Chemistry, S.S.Dara

INSTRUCTIONS FOR PRACTICALS

Maximum Marks: 100

Duration : Six hours

The Board of Examiners will constitute of one External Examiner and one Internal Examiner

Marking Scheme

Exercise	Marks
A. Analysis of Cement	30
B. Analysis of Polymers	30
C. Preparation of polymers	20
D. Record	10
E. Viva	10
Grand Total	100

M.Sc Applied Chemistry Semester- IV Examination

Paper: XVI PHARMACEUTICAL CHEMISTRY

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit I

Drug Design-I

Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrug and soft drugs, structure-activity relationship (SAR), factors affecting bioactivity. Theories of drug activity: occupancy theory, rate theory, induced fit theory.

Drug Design-II

Quantitative structure activity relationship (QSAR), History and development of QSAR. Concept of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Free-Wilson analysis, relationships between Free-Wilson and Hansch analysis. LD-50, ED-50 (Mathematical derivations of equations excluded.)

Unit -II

Pharmacokinetics

Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics, uses of pharmacokinetics in drug development process.

Pharmacodynamics

Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit-III

Drugs against infection

Introduction and general mode of action.

Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapson, amino salicylic acid, isoniazid, ethionamide, ethambutol, fluconazole, econazole, griseofulvin, chloroquin and primaquin.

Antibiotics

Cell wall biosynthesis, inhibitors, β -lactam rings, antibiotics inhibiting protein synthesis. Synthesis of penicillin G, cephalosporin, Streptomycin, ampicillin, amoxycillin, tetracycline.

Books Suggested:

1. Burger's Medical Chemistry, M.E. Wolff, John Wiley sons N.Y
2. Principles of Medicinal Chemistry, W.O. Foye and Febiger Philadelphia
3. The Organic Chemistry of drugs synthesis, D Ledwith and L N Mitscher, John Wiley & Sons N.Y.
4. Medicinal Chemistry, A Kar, Wiley Eastern Ltd N.Y.
5. A Text book of Synthetic Drugs, O D Tyagi M Yadav, Anmol Publications
6. An Introduction to drug design, S N Pandey, J R Demmock, New age international Publishers
7. Biopharmaceuticals & Pharmacokinetics, D M Brahnanabankar, Suil B Jaiswal
8. Introduction to Pharmaceutical II, A K Gupta S S Bajaj, CBS Publishers and Distributors
9. Computer for Chemists, Pundir, Pragati Prakashan
10. Computer and their application to chemistry, Ramesh Kumari, Narosa Publishing House

Paper: XVII SEPARATION TECHNIQUES

Duration : 3 Hrs. Max. Marks:40

Unit-I

Solvent Extraction and Ion Exchange: -

Basic principle of solvent extraction (Distribution law), Factor affecting extraction, Techniques of extraction, Quantitative treatment of solvent extraction equilibria, classification & types of solvent extraction system, mechanism of extraction, advantages & application in analytical chemistry Introduction of counter current extraction, Craig's technique & its application.

Ion Exchange – Definition, types of ion exchangers, preparation , action and applications of ion exchangers.

Unit-II

Chromatography- I

An introduction to chromatographic methods, paper, thin layer and column chromatography, theory of chromatography, classification of chromatographic techniques, retention time, relationship between retention time and partition coefficient, the rate of solute migration, band broadening & column efficiency, applications of chromatography in qualitative and quantitative analysis.

UNIT – III

Chromatography- II

Instrumentation and applications of Gas Chromatography(GC) and High Pressure Liquid Chromatography or High Performance Liquid Chromatography(HPLC) , comparison of GC and HPLC, Ion chromatography, size exclusion chromatography, super critical fluid chromatography, affinity chromatography and its specialized analytical applications

Books Suggested :

1. Instrumental Methods of Chemical Analysis – Will and Letton Edu.Pub. Ltd New York
2. Instrumental Methods of Chemical Analysis – Chatwal Anand, Himalaya Pub.
3. Spectroscopy of Org. Compounds – P.S. Kalsi, New Age Inter. Pub.

4. Instrumental Methods of Chemical Analysis – B.K. Sharma, Goel Pub. Meerut
5. Instrumental Methods of Chemical Analysis – H. Kaur, Pragati Pub.
6. Instrumental Methods of Chemical Analysis by Golen W. Ewing. McGraw Hill

PAPER- XVIII ANALYTICAL METHODS

Duration : 3 hours

Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A , Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions.

Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit I

General Analytical Chemistry: -

Importance, applications, & scope of analytical chemistry, classification of analytical methods-(classical and instrumental), selecting analysis method, Sampling, Definition and purpose of sampling. Sampling of gases. Ambient & stack sampling, sampling of solids & liquids, techniques of weighing , possible errors, calibration of glassware, sample preparation – dissolution and decompositions.

UNIT-II

Titrimetric , Gravimetric and Thermal Methods of Analysis

General principles of Volumetric analysis, concentration systems, acid-base, complexometric, precipitation, oxidation-reduction titration, theories, its applications , theory & application of gravimetric analysis, Process & treatment of precipitation , Co-precipitation and ageing , Organic precipitation. Theory, instrumentation & application of thermo gravimetric & differential thermal Analysis. Thermal methods in quantitative analysis.

Unit-III

Conductometry and Conductometric titrations: -

General principle of conductometry, instrumentation, electrolytic conductance and electrolytic concentration relationship, conductometric titrations including neutralization, precipitation, oxidation-reduction, complexation and high frequency titrations other applications of analytical importance.

Books suggested:

1. Analytical Chemistry by J.G. Dieckmann Pub. International Students Edition.
2. Instrumental Methods of Chemical Analysis by H.H. Willard & L.L. Merritt. Pub. Affiliated East West Press
3. Analytical Chemistry by R.M. Verma Pub. CBS Pub. & Distributors Delhi
4. Instrumental Methods of Chemical Analysis by Golen W. Ewing Pub. Int. Stu. Edu.
5. Vogel's Text book of Quantitative Chemical Analysis by G.H. Geffery, J. Bassett. Pub. Lachman Scientific Tech. John Wiley New York
6. Instrumental Methods of Chemical Analysis by Gurdeep Chatwal, Sham Anand. Pub. Himalaya Pub. House
7. Analytical Chemistry, 6th edn D. Christian Wiley

PAPER- XIX CHEMICAL ANALYSIS

Duration : 3 hours Maximum Marks : 40

Note :- The paper is divided into three independent units. The question paper is divided into three Parts - Part A, Part B and Part C. Part A (8 marks) is compulsory and contains 8 questions (20 words each). Each question is of one mark. Part B (8 marks) is compulsory contains four questions at least one question from each unit. Candidate is required to attempt all four questions. Each question is of two marks (50 words each). Part C (24 marks) contains six questions two from each unit. Candidate is required to attempt three questions, one from each unit. Each question is of 8 marks (400 words)

Unit-I

Food Analysis

Moisture, ash, crude protein, fat, crude fibre, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulterants in food, contamination of food stuffs. Tests for detection of adulterants in food stuffs, Pesticide analysis in food products- Extraction and purification of sample, Gas chromatography for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.

Unit-II

Fuel Analysis: characteristic & classification of fossil fuels-solid, liquid and gas. Ultimate and proximate analysis of coal, grading of coal. Liquid fuels-flash point, fire point, cetane number, octane number and carbon residue. Gaseous fuels-producer gas and water gas, calorific value and its determination.

Unit-III

(A) Industrial water treatment: - Water as engineering material. Treatment of water for steam generation, (boiler feed water) boiler problem, remedies and its numerical problems.

(B) Lubricants -

Properties, classification, Physico chemical analysis and testing of lubricants- viscosity and viscosity index, flash point, fire point, aniline point, iodine value, saponification value, acid value.

(C) Testing of dyes -

Testing of fastness properties, effect of light, washing agents and rubbing on dye shades.

Books Suggested:

1. Standard Methods of Chemical Analysis , Vol iii (Van Nostrand Reinhold Co.), F.J. Welcher
2. Instrumental Methods of Chemical Analysis : Chatwal & Anand: Himalaya Publishing House, New Delhi
3. Vogel's Text Book of Quantitative Chemical Analysis : J. Mendham et al : 6th edn 2008
4. A Handbook of Chemical Analysis, 2005 , Pooja Bhagwan
5. Applied Chemistry, A K Bagavathi Sundary, MJP Publishers
- 6.

PAPER-XX - PRACTICAL

Duration: 6 Hrs. Max.Marks:100

Practicals

A. Fuel Analysis (Minimum Three)

- 1.The proximate analysis of given sample of coke and wood charcoal.
2. The ultimate analysis of given sample of soft coke.
3. Determine the swelling index of coal .
4. Determine Phosphorus present in coal.
- 5.Determine the viscosity in centistokes of a given sample of oil at temperature 37.8°C, 50°C, 70°C, and 99°C using Redwood Viscometer and calculate the viscosity index of the oil sample. Data or Theta – 40 to 85 Sec, A=0.0026, B=1.90 For Theta =82 to 2000Sec. A=0.0026, B=0.65
6. Determine the viscosity of a given sample of Oil in centistokes at room temperature and at 40°, 50°, 60° 65°, 70°C by Redwood Viscometer. Plot a graph between kinematic viscosity and temperature in degree centigrade.

B. Lubricant Analysis (Minimum Five)

1. Determine Acid Value of lubricating oil.
2. Determine Saponification Value of a lubricating oil
3. Determine Iodine Value of lubricating oil.
4. Determine Aniline Point of lubricating oil.
5. Determine Cloud- Point and Pour-Point of lubricating oil.
6. Determine Flash Point of lubricating oil.
- 7.Determine Fire Point of Lubricating Oil.
8. Determine Rancidity of oil sample.

C. Preparation of Drugs and Drug intermediates (Minimum Two)

1. Preparation of Aspirin.

2. Preparation of Paracetamol
3. Preparation of Salol
4. Preparation of Sulphanilic acid

Books suggested:

- 1..Advanced Practical Chemistry, JagdambaSingh ,PragatiPrakashan
- 2.Experiments and Calculations in Engineering Chemistry, S.S.Dara

INSTRUCTIONS FOR PRACTICALS

Maximum Marks: 100

Duration : Six hours

The Board of Examiners will constitute of one External Examiner and one Internal Examiner

Marking Scheme

Exercise	Marks
A. Fuel Analysis	35
B. Lubricant analysis	25
C. Preparation of Drugs and Drug intermediates	20
D. Record	10
E. Viva	10
Grand Total	100

