

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

SYLLABUS FOR M.Sc. PART-I (from June, 1992)

CHEMISTRY.

- 1) Each theory course for M.Sc. should be covered in 4 periods, each of 60 minute duration per week per course including lectures, tutorials, seminars.
- 2) Each practical course will require 6 hours of laboratory work per week.
- 3) There should not be more than 10 students in a batch of M.Sc. practical course.
- 4) The students taking physical chemistry for m.Sc. must have offered mathematics at XIIth std. and F.Y.B.Sc.
- 5) Some students may offer 'Project' in lieu of one practical course of fourth semester. For Project work the batch will consist of 5 students and work-load be calculated accordingly.
- 6) Examination of all theory and practical courses will take place at the end of the semester.
- 7) All theory and practical courses at M.Sc. Part-I will be University courses.

SEMESTER	THEORY COURSES	PRACTICAL COURSES.
I	1) Ch-110 Physical Chemistry 2) CH-130 Inorganic and Analytical Chemistry 3) CH-150 Organic Chemistry	Ch-107 Analytical Chemistry CH-127 Inorganic Chemistry
II	1) CH-210 Physical Chemistry 2) CH-230 Inorganic and Analytical Chem. 3) CH-250 Organic Chemistry	CH-207 Physical Chemistry CH-247 Organic Chemistry

- 8) In theory course CH-130 and CH-230, section A is compulsory. Students may offer any one section from sections B and C.

M.Sc. Part - I Syllabus

PHYSICAL CHEMISTRY - I

SECTION - I

1. Thermodynamics:- State functions and differentials :- State function, exact and inexact differentials, change in internal energy. Manipulatory the first law of thermodynamics. temperature dependence of internal energy, the temperature dependence of enthalpy, Joule-Thomson effect, Relation between C_v and C_p . Work of adiabatic expansion, irreversible adiabatic expansion, reversible adiabatic expansion. Measuring dispersal, the second law, the definition of entropy, the entropy change in the system, natural events, entropy change when a system is heated, entropy changes in the surroundings, the entropy of phase transition, the entropy of irreversible change, Carnot efficiency, the Helmholtz and Gibbs functions, maximum work, remarks on the Gibbs function, evaluating the entropy and the Gibbs function, the third law of thermodynamics, third law entropies, standard molar Gibbs functions.

Lectures (5)

Ref. :- Pages 57 to 75 Chapter No.3
Pages 96 to 117 Chapter No.5

2. Changes of state :- Partial molar quantities, the thermodynamics of mixing, colligative properties,

Lectures (7)

Ref. :- Pages 161 to 176 Chapter No.8

3. Elements of statistical thermodynamics :- Energy of molecules, Boltzmann dist distribution law. Partition functions, translational, rotational, vibrational and electronic partition functions, thermodynamic functions- energy, heat capacity, entropy and free energy from partition functions.

Lectures (8)

Ref.4 :- Pages 751 to 765, Chapter No. 18

4. Equilibrium electrochemistry:- (ions and electrodes) :- The activities of ions in solution, the Debye-Huckel theory, the role of electrodes, the electrical potential at interfaces

Lectures (6)

Ref.1: Pages 235 to 253, Chapter No.11

SECTION-II

5. Chemical Kinetics :- Accounting for the rate laws, simple reactions, temperature dependence of reaction rates, reactions approaching equilibrium, consecutive reactions, steady state approximation, pre-equilibria, unimolecular reactions, kinetics of complex reactions:- Chain reactions, structure of chain reactions, explosive reactions, Fast reactions :- Flash photolysis, flow techniques, relaxation methods.

Lectures (12)

Ref.1: Pages 698-709, 713-716, 720, 729-732

6. Molecular reaction dynamics:- Collision theory, Diffusion controlled reactions, activated complex theory, the reaction coordinate and the transition state, formation and decay of the activated complex, Eyring equation, thermodynamic aspects, reactions between ions, Dynamics of molecular. Collisions :- Reactive encounters, potential energy surfaces, motion through the surface, results of molecular beam studies.

Lectures (10)

Ref.1: Pages 737-758

NOTE :- There should be a 20% weightage to numerical problems in the question paper.

References:-

- 1) Physical chemistry, P.W. Atkin, ELBS, third edition 1986
- 2) Chemical kinetics, K.J. Laidler, TMH Edition.
- 3) Elements of chemical thermodynamics, L.K. Nash
- 4) Principles of Physical chemistry, S.H. Maron and C.F. Prutton (4th edition)

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SYLLABUSM.Sc. Part - I Inorganic Chemistry I : CH-130Section A:

- (1) Wave mechanics, matter waves. The uncertainty Principle, the wave nature of electron, interpretation of wave function, normalised and orthogonal wave functions, the wave equation, the Principle of superposition. (3)
 Ref.1: Pages 26 to 38
 Ref.2: Pages 6 to 9
 Ref.3: Pages 10 to 11
 Ref.4: Pages 50 to 55
 Ref.7: Pages 9 to 13
- (2) The particle in a box; the particle in a one dimensional box, the particle in a three dimensional box, degeneracy. (4)
 Ref.1: Pages 38 to 44
 Ref.2: Pages 46 to 50
- (3) The hydrogen atom :- Transformation of coordinates, separation of variables, the ϕ (Phi) equation, the θ (theta) equation and the radial equation. Spherical harmonics, quantum states the electron spin, energy states of hydrogen atom, Wave functions of the hydrogen atom, radial distribution curves, angular dependence of the wave function. (7)
 Ref.1 : Pages 45 to 65
 Ref.2 : Pages 14 to 20
 Ref.3 : Pages 52 to 62
- (4) Molecular orbital theory of polyatomic molecules like BeH_2 , BF_3 , CH_4 , NH_3 and H_2O . (6)
 Ref.7 : Pages 87 to 95
 Pages 106 to 117
 Pages 120 to 126
 Pages 129 to 140
 Pages 141 to 147
- (5) (a) Molecular orbital theory for metal-ligand bonding in octahedral complex, MX_6 .
 Ref.9: Pages 359 to 362
- (b) Structural and thermodynamic effects of orbital splittings. (4)
 Ref.9 : Pages 372 to 376

-: Section - B :-

- (1) Material science : Wave mechanical band model and zone theory to explain the electrical conductivity of solids, Intrinsic and extrinsic semiconductors. Fermi level, temperature dependence of conductivity, charge carriers, mobility of charge carriers, p-n, n-p, n-p-n and p-n-p junctions. Transistors, photovoltaic effect, solar cell. (10)
Ref. 8: Chapter 12, Pages 310 to 350
- (2) Inorganic Chemistry in aqueous media-conventions and units in aqueous solution chemistry, Hydration energies and solubilities of ionic salts. The strength of acids in aqueous solution, complex formation, Redox processes, the stabilization of oxidation states by complex formation or precipitation, potential diagrams and oxidation state diagrams, factors affecting the magnitudes of standard redox potentials. (7)
Ref. 5: Pages 103 to 136
Ref. 6: Pages 167 to 195
- (3) Water pollution :- (a) Water pollutants and water quality parameters.
Ref. 10:A: Pages 169 to 192
 Pages 210 to 214
(b) Water treatment process
Ref. 10: Pages 287 to 297 (7)

-: SECTION - C :-

TECHNIQUES OF SEPARATION:-

- (1) Solvent extraction, Principles and techniques of solvent extraction, multiple extraction. (5)
- (2) Chromatography : Principles and classification of various techniques. (4)
- (3) Study of following chromatographic techniques : Column chromatography, paper chromatography and electro phoresis, ion exchange chromatography, exclusion chromatography, thin layer chromatography.
Introduction to G.L.C. & H.P.L.C. (12)

NOTE ON CH-130 :-

Section A is compulsory. Students will opt for section B or C.

References :-

- 1) Theoretical Inorganic Chemistry, 2nd ed.
By Day and Selbin (An East West-Edition)
Van Nostrand and Reinhold company.
- 2) Advanced Inorganic Chemistry (2nd ed.) 1966.
By F.A. Cotton and G. Wilkinson,
Interscience Publishers.
- 3) Concepts and Models of Inorganic Chemistry 1970,
By B.E. Douglas and D.H. McDaniel,
Oxford and I.B.H. Publishing Co., New Delhi
- 4) Inorganic Chemistry, (3rd ed.) 1967
By R.B. Meslopp and P.L. Robinson
Elsevier Publishing Company
- 5) Modern aspects of Inorganic Chemistry, (4th ed.) 1973.
Universal Book Stall, New Delhi.
- 6) Inorganic Chemistry, (ELBS ed.) 1984.
By A.G. Sharpe
ELBS and Longman.
- 7) Electrons and Chemical Bonding, 1964
By H.B. Gray
W.A. Benjamin, Inc. New-York
- 8) Introduction to solids. T.M.H. Edition, 1977.
By L.V. Azaroff
Tata - Mc.Graw Hill Publishing company Ltd., Bombay.
- 9) Basic Inorganic Chemistry, 1976
By F.A. Cotton and G. Wilkinson.
Wiley Eastern Limited, New Delhi.
- 10) (A) Environmental Chemistry, 2nd ed.
By Anilkumar De.
- 10) (B) Water Pollution
By Dr. V.P. Kudesia
Pragati Prakashan, Meerat
- 11) Analytical Chemistry (2nd ed.)
By G.D. Christian
Wiley

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M.Sc. Part I Syllabus CH-150

ORGANIC CHEMISTRY - I SEMESTER -I

1. Inductive effect, Resonance effect, Hyperconjugation, Acidity and Basicity. Ref.2 : Relevant pages	(6)
2. Energetics kinetics and the investigation of mechanism Ref. 2 : Pages 33-51	(6)
3. Nucleophilic Aliphatic Substitution Ref.1 : Pages 174-213	(12)
4. Elimination reactions Ref.1 : Pages 265-289	(6)
5. Addition reactions Ref.1 : Pages 312-328, 400-405	(6)
6. Nucleophilic Aromatic substitution, Aryne intermediates Ref.1 : Pages Relevant pages	(6)
7. Conformations of acyclic molecules Ref.3 : Pages 124-139	(6)

Total lectures	48

REFERENCES:-

1. Organic Chemistry by Morrison and Boyd, 5th edition (Prentice Hall) (1989)
2. A Guide book to mechanism in organic Chemistry by Peter Sykes (5th edition) orient longman group Ltd. (1982)
3. Stereochemistry of carbon compounds by E.L. Eliel. International students edition.

Additional reference :-

4. Fundamentals of organic chemistry by T.W. Graham solomons (2nd- (2nd edition) John wiley and Sons. (1985)
5. Organic Chemistry by Stanley H. Pine (5th edition) Mc.Graw. Hill international edition (1987)

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M.Sc. Part I Semester - I Syllabus
Practicals In Analytical Chemistry (Ch-107)

N.B. :- Perform four experiments from each section.

:- SECTION - A :-

- 1) Colorimetric estimation of vanadium.
- 2) Potentiometric estimation of $\text{Cu}^{2+}/\text{Ni}^{2+}$ using EDTA.
- 3) Conductometry - Electrolytic nature of compounds such as $\text{K}_3(\text{Fe}(\text{CN})_6)$, $\text{Ba}(\text{NO}_3)_2$, KCl
- 4) Determination of Phosphorus from the fertilizer.
- 5) Estimation of Calcium from a drug sample.

:- SECTION-B :-

- 1) Steam distillation - Separation of a given binary mixture and determination of yield and mpt. of the separated compounds.
- 2) Column Chromatography - Separation of a given binary mixture and determination of yield and m.pt. of the separated compounds.
- 3) Thin layer chromatography----Determination of R_f values of components of binary mixture.
- 4) Estimation of Hydroxyl groups in alcohol/Phenol by acetylation method.
- 5) Estimation of amino group by acetylation.

:- SECTION - C :-

- 1) To determine the amount of aspirin in the given tablet.
- 2) Determination of half wave potential ($E^{1/2}$) and unknown concentration of an ion ($\text{Cd}^{2+}/\text{Zn}^{2+}$)
- 3) Colorimetric analysis of a mixture of Co^{2+} and Ni^{2+}
- 4) Cu^{2+} ion-----EDTA Photometric titration.
- 5) Determination of the composition of $\text{Cu}(\text{II})$ and $\text{Fe}(\text{III})$ solution Photometric titration with EDTA.

X-X-X-X-X-X

M.Sc. Part-I Semester-I Syllabus

PRACTICALS IN INORGANIC CHEMISTRY (CH-127)

N.B.:- Experiments from section A are all compulsory.
perform any five experiments from section B.

-: Section A :-

- 1) Ore analysis - Pyrolusite ore (SiO_2 and Mn)
- 2) Alloy analysis - Solder alloy (Tin and lead)
- 3) Synthesis of the following compound and estimation of the metal ion.
(1) Cis-trans Potassium diaquo dioxalato chromate (III)
- 4) Synthesis of the following compound and estimation of the metal ion.
(1) Chloropentammine cobalt (III) chloride
- 5) Synthesis of the following compound and estimation of the metal ion.
(1) Potassium trioxalato aluminate
- 6) Simultaneous determination of ($\text{Cr}^{6+} + \text{Mn}^{7+}$) spectrophotometrically
- 7) Estimation of each of the constituents of the following binary mixture.
 $\text{Co}^{2+} + \text{Ni}^{2+}$
- 8) Determination of Zn^{2+} with $\text{K}_4(\text{Fe}(\text{CN})_6)$ potentiometrically

-: SECTION - B :-

- 1) Thermochemistry - Determination of Lattice energy of binary salts by heat of dissolution; systems such as CaCl_2 , NiCl_2 , CuCl_2 , MnCl_2 , and CoCl_2 .
- 2) Ore analysis - Haematite ore (silica and Fe)
- 3) Alloy analysis - Brass alloy (Cu and Zn)
- 4) Effect of impurity ion addition on the Beer's law curve of systems
 - i) Ni^{2+} on Co-R. Nitroso salt
 - ii) Fe^{3+} on $\text{V}^{5+} - \text{H}_2\text{O}_2$
 - iii) Cu^{2+} on Fe^{3+} - Sulphosalicylic acid
- 5) Alloy analysis - steel (Fe and Ni)
- 6) Estimation of each of the constituents of the following binary mixture- ($\text{Fe}^{3+} + \text{Cr}^{3+}$)
- 7) Synthesis of the following compound and estimation of the metal ion.
 - (i) Tris ethylenediamine nickel (III) thiosulphate.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.SC.PART I SYLLABUS (FROM JUNE 92)

PHYSICAL CHEMISTRY-II

COURSE: CH-210

SECTION-I

(MOLECULAR SPECTROSCOPY)

1. Regions of the spectrum, representation of spectra, Basic elements of practical spectroscopy, signal-to-noise ratio, width and intensity of spectral lines, Fourier transform spectroscopy, enhancement of spectra.
Ref. :1:, Chapter-1 L-(2)
2. Microwave spectroscopy: Rotation of molecules, rotational spectra of diatomic and polyatomic molecules, intensities of rotational lines, isotope effects, nonrigidity, applications.
Ref. :1: Chapter:2 L- (4)
3. Infrared spectroscopy: Harmonic and anharmonic oscillators, vibration-rotation spectra of di-and polyatomic molecules without and with interaction, nuclear spin effects, applications.
Ref. :1:, Chapter:3 L-(6)
4. Raman spectroscopy: The classical and quantum theories of the Raman effect, rotational, vibrational and vibration-rotation Raman spectra of di-and polyatomic molecules, polarization of Raman lines, rules of mutual exclusion, applications.
Ref. :1:, Chapter:4 L-(4)
5. Electronic spectroscopy of molecules: Born-Oppenheimer approximation electronic spectra of di-and polyatomic molecules, vibrational coarse structure, rotational fine structure, dissociation energy and dissociation products, electronic structure of diatomic molecule molecular photoelectron spectroscopy, applications.
Ref. :1:, Chapter-6 L-(8)

NOTE: The techniques and instrumentation in Chapter No. 2,3,4, and 6 need not be taught.

SECTION II

6. Radioactivity: Parent- daughter decay-growth relationships, Branching decay, alpha decay, beta decay, nuclear isomerism and isomeric transition, internal conversion, Auger effect.
Ref. :2:, pages 98-126, 141-145 L (8)
7. Elements of radiation chemistry: Interaction of radiation with matter, passage of neutrons through matter, Interaction of gamma radiation with matter, units for measuring radiation absorption, radiation dosimetry, radiolysis of water, free radicals in water radiolysis of aqueous solutions.
Ref. :2:, Pages- 294-318 L- (5)

8. Applications of radioactivity: Probing by isotopes, typical reactions involved in the preparation of radioisotopes, radiochemical principles, typical applications of radioisotopes, physico-chemical, analytical, medical, industrial and agricultural applications. Determination of age of minerals- earth and rocks. L- (5)

Ref: 2 : Pages 237-248, 256-258, 265-269, 276-286

9. Phase rule: The phase rule and its derivation, meaning of terms, One-component, two-component and three-component systems. L- (6)

Ref. :6: Pages 192-207.

NOTE: There should be a 20% weightage to numerical problems in the question paper.

REFERENCES:

1. Fundamentals of molecular spectroscopy, C.N.Banwell, TMH, 3rd edition.
2. Essentials of nuclear chemistry, H.J.Arnikaar, Second edition.
3. Source book on atomic energy, S.Glasstone, D.Van. Nostrand and company, East-West press edition.
4. Nuclear and radiochemistry, G.Friedlander, J.W.Kennedy E.S.Macias and J.M.Miller.
5. Introduction to nuclear physics and chemistry, B.G. Harvey
6. Physical chemistry, P.W.Atkins, third edition (ELBS)

PHYSICAL CHEMISTRY PRACTICALS

CH-207(IInd TERM)

A. CONDUCTOMETRY:

1. Hydrolysis constant of aniline hydrochloride.
2. Kinetics of the saponification of ethyl acetate.
3. Titration of a mixture of HCl and CH_3COOH against NaOH.
4. To verify Debye-Huckel and Onsager's limiting law for NaCl/KCl.
5. To determine the solubility of sparingly soluble salt such as PbSO_4 or BaSO_4 .

B. POTENTIOMETRY:

1. Estimation of halides in a mixture (Binary)
2. Stability constant of a complexion.

C. pH METRY:

1. Titration of phosphoric acid (H_3PO_4) solution against an alkali and to determine the ionization constants of the acid.

D. COLORIMETRY:

1. PK value of an acid-base indicator.

E. RADIOACTIVITY:

1. Half line of a radioactive nuclide.
2. Determination of E_{\max} of beta-radiation and absorption coefficients in aluminium.

F. CHEMICAL KINETICS

1. Kinetics of decomposition of diacetone alcohol by dilatometry.
2. To study the rate of acid-catalysed iodination of acetone in presence of excess of acid and acetone.
3. Verification of Bronsted primary salt effect.

G. NON-INSTRUMENTAL:

1. Transport numbers of H^+ and Cl^- ions by moving boundary method.
2. Freundlich and Langmuir isotherms for absorption of acetic acid on activated charcoal.

NOTE:

Each student should complete a minimum of 12 experiments with at least one experiment from each technique.

REFERENCES:

1. Experiments in physical chemistry, J.M.Wilson, R.J.Newcombe, A.R.Denaro, Rickett. (Pergamon Publ.)
2. Experimental physical chemistry, R.C.Das, and B.Behera (Tata-Mc-Graw-Hill Edn.)
3. Advanced practical physical chemistry, J.B.Yadav (Goel publishing House, Meerut)
4. Practical Physical Chemistry, A.Findlay, T.A.Kitchner.

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M.Sc. PART-I SYLLABUS CH-247
ORGANIC CHEMISTRY (PRACTICALS)

1. Derivatives of functional groups

<u>Functional Group</u>	<u>Name of derivative</u>
i) $-C-OH$ (Carboxylic acid)	Amide, Anilide
ii) $Ar-OH$ (Phenol)	Aryloxy acetic acid
iii) $-NH_2$ (Amine)	Acetyl, Benzoyl
iv) $C=O$ (Aldehyde)	Oxime, Semicarbazone
v) $\begin{matrix} & & & & \\ & & & & \\ & & & & \\ & & & & \\ H & C=O & & & \end{matrix}$ (Ketone)	Oxime, Semicarbazone (6)

2. Single stage preparation (any six)

- i) Anisole Nitration 2,4 Dinitroanisole
- ii) Benzophenone Redⁿ Benzhydrol
- iii) Anthracene Oxidⁿ Anthraquinone
- iv) P-Nitroaniline Substitution P-Iodonitrobenzene
- v) P-Toluidine Substitution P-Chlorotoluene
- vi) Acetoacetic ester Condensation 1-Phenyl-3 Methyl-5-Pyrazolone.
- vii) m-Dinitrobenzene Redⁿ m-Nitroaniline
- viii) o-Nitrotoluene oxidⁿ o-Nitrobenzoic acid. (6)

3. Two stage preparations (any two)

- i) Acetophenone - Benzal acetophenone- epoxide
- ii) Benzophenone- Oxime - Benzanilide
- iii) Phthalic anhydride-phthalimide-anthranilic acid
- iv) Hydroquinone-Quinone-1,2,4, triacetoxy benzene (4)

Total practicals 16

REFERENCES:

1. Practical organic chemistry by A.I.Vogel
2. Laboratory manual of organic chemistry
2nd edition by Raj K.Bansal (1990)
(Wiley Eastern Ltd.)

M.SC.PART I SYLLABUS CH-250
ORGANIC CHEMISTRY:II SEMESTER-II

1. Electrophilic aromatic substitution.
Ref. 1: Pages 499-529 Ref. :2: Relevant Pages.
Nucleophilic aromatic substitution.
Ref. 1: pages 1029 - 1057 & Ref. 2: Relevant pages (8)
 2. Rearrangements
Ref. 1: Pages 1101-1125 & Ref. 2: Relevant pages. (6)
 3. Stereochemistry- The actual shape of six membered ring
and its relation to properties and reactivity
Ref. :3: pages 204-234 (8)
 4. Symphoria: Neighbouring group effects
Ref. 1: pages 733-758
 5. Oxidation and reduction using following reagents:-
 $\text{Na}_2\text{Cr}_2\text{O}_7$, OsO_4 , $\text{Pb}(\text{OAc})_4$, KMnO_4 , N-Bromosuccinamide (NBS),
Liberane, H_2O_2 & peracids, periotic acid, $\text{Na}/\text{Liq.NH}_3$,
Amines, NaBH_4 , LiAlH_4 , Hydrazination, Catalytic reduction
Ref. 6: Relevant pages. (6)
 6. Spectroscopy and structure (UV, IR, NMR, Mass & e^{13})
Ref. 1: pages 569-631 (16)
- Total lectures 48

REFERENCES:

1. Organic chemistry by Morrison and Boyd
(5th edition) prentice Hal (1989)
2. A Guide book to mechanism in organic chemistry
by Peter Sykes, 5th edition (1982)
3. Stereochemistry of Carbon compounds by
E.L.Eliel. International students edition.
4. Fundamentals of organic chemistry by
T.W.Graham Solomon (2nd edition) John Wiley and Sons(1985)
5. Organic Chemistry by Stanley H.Pine
5th edition. Mc GRAW. Hill international edition. (1987)
6. Organic Chemistry by D.J.Cram
G.S.Hammond 2nd or 3rd edition Mc GRAW (1964)

w.r.t. fundamental properties.

Ref.:8 and Ref.:9, relevant pages.

(6)

-: SECTION- 'C' :-

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS :-

1. Visible spectrophotometry and colorimetry:
Introduction, theory, deviation from Beer's law,
Instrumentation, applications, spectrophotometric titrations.
Ref.:12, Chapters 3 and 4
Ref.:13, Chapter 5
(6)
2. Atomic absorption spectroscopy: Introduction, principle,
differences between AAS and FES, advantages of AAS over FES,
disadvantages of AAS, Instrumentation, single and double
beam AAS, detection limit and sensitivity, interferences,
applications.
Ref.: 13, Chapter 12
Ref.: 12, Chapter 12
(6)
3. Flame photometry: Introduction, principle, instrumentation,
applications, Interferences, factors affecting the intensity
of emitted radiation.
Ref.:13, Chapter 14
(3)
4. Nephelometry, and turbidimetry: Introduction, turbidimetry
and colorimetry, nephelometry, and fluorimetry, choice between
nephelometry and turbidimetry, theory, instrumentation and
application;
Ref.:13, Chapter 15
(2)
5. pH metry:- Definition, determination, hydrogen electrode,
quinhydrone electrode, glass electrode, instrumentation,
pH titrations
Ref.:13, Chapter 21
Ref.:12, Chapter 20
(3)
6. Polarography and related techniques.
A brief account of polarography, introduction, apparatus used
for amperometric titrations, techniques and types of
amperometric titrations, titrations with two indicator
electrodes, advantages and disadvantages of amperometric
titrations, applications, cyclic voltametry,
chronopotentiometry.
Ref.:13, Chapter 23,24
Ref.:12, Chapter 22,25
(4)

NOTE ON CH-230-

Section A is compulsory. Students will opt for section B or Section C.

REFERENCES:

1. Chemical applications of group theory
By- F.A.Cotton
2. Theoretical inorganic chemistry (2nd ed.)
Day and Selbin (An East West Edition)
Van Nostrand Reinhold Company
3. Electrons and Chemical bonding, 1964
By H.E.Gray
W.A.Benjamin, Inc. New York
4. Concepts and models of Inorganic Chemistry, 1970
By Douglas and Mc.Daniel
Oxford and IBH Publishing Co., New Delhi
5. Modern aspects of Inorganic Chemistry, 4th ed., 1973.
Universal Book Stall, New Delhi.
6. Inorganic Chemistry, 3rd ed. 1967
By R.B.Heslop and P.L.Robinson
Elsevier Publishing Company.
7. Introduction to solids, T.M.H. edition, 1977
By L.V.Azaroff, TMH Co.Ltd., Bombay.
8. Inorganic Chemistry ELBS edition, 1984
A.G.Sharpe, ELBS Longman
9. A new concise Inorganic Chemistry
By J.D.Lee
10. Fundamental Concepts of Inorganic Chemistry
By E.S.Gilreath
11. Symmetry in Chemistry, 1971
By H.H.Jaffe and M.Orchin
Wiley Eastern Pvt.Ltd., New Delhi
12. Instrumental methods of analysis- By
H.H.Willard, L.L.Merritt, J.A.Dean, 5th ed.
13. Instrumental methods of chemical analysis,
By G.Chatwal, S.Anand
Himalaya Publishing House.

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