



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN – 384265

Faculty of Science

Revised M.Sc. Chemistry Syllabus

Sem ester – 1

PROGRAM : HNGU 2058

W.E.F. June -2019 (and thereafter)

DATE : 25/09/2019




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TOTAL PAGE: 22

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CURRICULUM
Hemchandracharya
North Gujarat University, Patan.
M.Sc. (Chemistry) (WEF June:
2019) General Information of Semester I & II
Syllabus According To CBCS Pattern

1. The medium of instruction, question papers as well as answers in examinations will be English only.
2. Passing standard: 40% As per the revised rules and regulation of Hemchandracharya North Gujarat University, Patan. (Aca/Axs/744/2018, Date 27/4/2018).
3. Viva voce will be pertaining to practicals.
4. The degree will be awarded in M.Sc. (Chemistry) in specialized branch. The curriculum will be common for semester – I & semester – II for all branches.
5. The result sheet of all semesters will contain the name of elective papers selected by the candidate, the grade and the credit secured.
6. A maximum of 10% students passing second semester may be allowed for dissertation at the 4th semester. Such students will be exempted from practical as well as viva of fourth semester, in lieu of that the dissertation of candidate will be assessed with 100 marks of dissertation and 50 marks of the viva of dissertation.
If the number of students willing to opt dissertation exceeds 10%, dissertation will be given on the basis of merit of combined marks of first and second semester. The dissertation will be allotted to the students in the beginning of third semester by head of the department/ P.G. Center.
7. Intake of students every center 25 (organic branch) 15 for Inorganic & physical branch, University Department. 55 (Inorganic, Organic and Physical branches)




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8. For semester, I & II

The internal evaluation for total 120 marks will be done as per the continuous evaluation process as under.

	Marks
a) Weekly test of theory (minimum 8)	56
b) Internal Practical examination (once a semester)	20
c) Students seminar (Once a Semester)	14
d) Problem Solving / New Practical	06
e) Book review (In students own handwriting, separate book for all)	07
f) Project work assessment (separate for all)	07
g) Quiz / Questionnaire	10

Total 120

9. A batch of Chemistry Practical will consist of 20 students per teacher.

10. For semester I, the paper, CHNN-401, CHNN-402, CHNN-403, CHNN-404 are compulsory. Furthermore, students will have choice to select any one of CHNN-405 A, CHNN-405B, or CHNN - 405C.

11. For semester II, the papers, CHNN-501, CHNN-502, CHNN-503, and CHNN-504 are compulsory. In addition, the student has a choice to select either CHNN-505 A or CHNN-505B.

12. For all the semesters, the total marks will be given out of 600. The cumulative grade will be as per university rules.

Note: During the preparation of this curriculum, ample care is taken for consideration of the followings:

- A. Model curriculum of U.G.C.
- B. Concept of continuous evaluation
- C. CGPA (Cumulative Grade Point Average Credit)
- D. CBCS (Choice Based Credit System)
- E. Semester approach
- F. Revised rules and regulation of Hemchandracharya North Gujarat University, Patan.
- G. NET (NATIONAL ELIGIBILITY TEST) curriculum

13. As per recent directive from university, all the 4 credit as well as 2 credit courses will have internal marks as indicated in the table.

14. For university Examination for each batch, maximum - 30 students / three examiners / 3 days.

15. The mark distribution of 150 marks of practicals will be as under from - (CHNN-406 + CHNN-407) - M.Sc. Sem-I

Inorganic Chemistry : 40 + 10 Viva (One full day)



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Organic Chemistry : 40 + 10 Viva (One full day)

Physical Chemistry : 40 + 10 Viva (One full day)

Total : 150 Marks

For M.Sc. Sem – II the distribution of 150 marks will also follow similar pattern and the exercises will be from CHNN – 506 + CHNN – 507.

OnedayeachforInorganic,OrganicandPhysicalchemistrybranch,Markswillbe 50 from each branch and hence total practical marks will be 150 (including viva), for CHNN- 406 and CHNN-407 for semester -I. Similar pattern will be for MSc. semesterII.




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M.Sc. (Chemistry) (WEF June: 2019).
Semester End Examination
Semester – I

Work Load	Paper No.	Subject	External Marks	Internal Marks	Credit
60 Hrs.	CHNN-401	Inorganic Chemistry	70	30	4
60 Hrs.	CHNN-402	Organic Chemistry	70	30	4
60 Hrs.	CHNN-403	Physical Chemistry	70	30	4
60 Hrs.	CHNN-404	Symmetry, Group Theory & Spectroscopy	70	30	4
✓ 30 Hrs	CHNN-405 A	Computers for Chemists	35	15	2
✓ 30 Hrs	CHNN-405 B	Computational Chemistry	35	15	2
✓ 30 Hrs	CHNN-405 C	Organic Spectroscopy	35	15	2
90 Hrs.	CHNN-406	Practical I	-----	-----	3
90 Hrs.	CHNN-407	Practical II	-----	-----	3
Total			465	135	24

*Each CHNN-406 and CHNN-407 includes 30 marks of viva in the total of 150 marks of viva voce examination. (Details as shown in 15.)

Working per semester minimum 90 days (15 weeks)



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M.Sc. (Chemistry) Semester – 1

Course: CHNN – 401 (Core compulsory)

Inorganic Chemistry

I Stereochemistry and Bonding in Main Group Compounds **12 Hrs**

VSEPR, Walsh diagrams (tri- and penta- atomic molecules), d-p, I bonds, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

II Metal-Ligand Equilibrium in Solution **8Hrs**

Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH - metry and spectrophotometry.

III Reaction Mechanism of Transition Metal Complexes **24Hrs**

Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer-sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.



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IV Metal-Ligand Bonding

16Hrs

Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, π -bonding and molecular orbital theory.

Books Suggested

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.~
3. Chemistry of the Elements, vN.N. Greenwood and A. Earnshaw, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetochemistry, F.I.L. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, F.L.D. Gillars and J.A. McCleverty, Pergamon.



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M.Sc. (Chemistry) Semester - 1

Course: CHNN-402(Corecompulsory)

Organic Chemistry

I Nature of Bonding in Organic Molecules

10Hrs

Delocalized chemical bonding—conjugation, cross conjugation, resonance, hyperconjugation, bonding in fullerenes, tautomerism.

Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of pi-molecular orbitals, annulenes, anti—aromaticity, homo-aromaticity, PMO approach.

Bonds weaker than covalent- addition compounds, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes.

II Stereochemistry

15Hrs

Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding.

Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape.

Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

III Reaction Mechanism: Structure and Reactivity

12Hrs

Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle.



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9.

Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Hard and soft acids and bases.

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, Benzyne, carbenes and nitrenes.

Effect of structure on reactivity - resonance and field effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation.

IV (A) Aliphatic Nucleophilic Substitution

15Hrs

The SN2, SN1, mixed SN1 and SN2 and SET mechanisms.

The neighbouring group mechanism, neighbouring group participation by Pi and sigma bonds, anchimeric assistance.

Classical and nonclassical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations.

The SNi mechanism.

Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon.

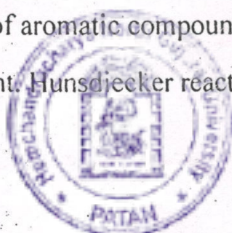
Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

(B) Free Radical Reactions

8Hrs

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity.

Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.



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Books Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C. K. Ingold, Cornell University Press.
5. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H. O. House, Benjamin.
7. Principles of Organic Synthesis, R. O. C. Norman and J. M. Coxon, Blackie Academic & Professional.
8. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
9. Reaction Mechanism in Organic Chemistry, S. M. Mukherji and S. P. Singh, Macmillan.
10. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
11. Stereochemistry of Organic Compounds, P. S. Kalsi, New Age International.



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M.Sc. (Chemistry) Semester - 1
Course: CHNN-403 (Core compulsory)

Physical Chemistry

Unit-I (A) Quantum Chemistry

15Hrs

Introduction to Exact Quantum Mechanical Results

The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.

(B) Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to the Helium atom.

Unit-II – (A) Angular Momentum

15Hrs

Ordinary angular momentum, generalized angular momentum, eigenfunctions for angular momentum, eigenvalues of angular momentum, operator using ladder operators, addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

(B) Electronic Structure of Atoms

Electronic configuration, Russell-Saunders terms and coupling schemes, Slater-Condon parameters, term separation energies of the pn configuration, term separation energies for the dn configurations, magnetic effects: spin-orbit coupling and Zeeman splitting, introduction to the methods of self-consistent field, the virial theorem.



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(C) Molecular Orbital Theory

Huckel theory of conjugated systems, bond order and charge density calculations.

Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene etc. Introduction to extended Huckel theory.

Unit-III Thermodynamics**15Hrs****Classical Thermodynamics**

Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar properties; partial molar free energy, partial molar volume and partial molar heat content and their significances. Determinations of these quantities.

Concept of fugacity and determination of fugacity.

Non-ideal systems: Excess functions for non-ideal solutions. Activity, activity coefficient,

Debye—Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength.

Application of phase rule to three component systems; second order phase transitions.

Unit-IV (A) Statistical Thermodynamics**15Hrs**

Concept of distribution, thermodynamic probability and most probable distribution.

Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and microcanonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers).

Partition functions - translational, rotational, vibrational and electronic partition functions, calculation of thermodynamic properties in terms of partition functions. Applications of partition functions.

Heat capacity behaviour of solids — chemical equilibria and equilibrium constant in terms of partition functions, Fermi-Dirac statistics, distribution law and applications to metal.

Bose—Einstein statistics — distribution law and application to helium.



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(B) Non-Equilibrium Thermodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations. electrokinetic phenomena: diffusion, electric conduction, irreversible thermodynamics for biological systems, coupled reactions.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGrawHill.
3. Quantum Chemistry, Ira N. Levine, PrenticeHall.
4. Coulson's Valence, R. McWeeny, ELBS.
5. Chemical Kinetics, K. J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose, McMillan.
7. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum
8. Modern Electrochemistry Vol. I and Vol. II, J.O.M. Bockris and A.K.N. Fieddy, Plenum.
9. Introduction to Polymer Science, V. Fl. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.



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M.Sc. (Chemistry) Semester - 1

Course: CHNN-404 (Core compulsory)
Symmetry, Group Theory & Spectroscopy

UNIT-01 Symmetry & Group Theory

16 Hrs

- Outline of symmetry elements and symmetry operation
- Schonflies method for determining the point group of the molecules.
- Multiplication of symmetry operation and multiplication table for C_{2v} , C_{3v} , C_{2h} .
- Equivalent symmetry elements, similarity transformation and conjugacy of symmetry operation within the point group
- Matrices: Characteristics, types of matrices (common & special), and Algebra of matrices (Particularly Multiplication)
- Use of Matrix and matrix representation of symmetry Elements and Their point groups (using various Vectors: position vector, translation vector, base vector)
- Γ_{3N} Representation: For H_2O , NH_3 , BF_3 , $PtCl_4$, PCl_5 , SF_6 , $POCl_3$, CCl_4 , Cis & $Trans$ N_2F_4 , $XeOF_4$
- Reducible and Irreducible Representation & character Table
- Characteristics of Irreducible Representation: The great orthogonality theorem
- Construction of Character Table For C_{3v} using properties of irreducible Representation
- Direct product and its utility.

UNIT 02 : Group theory and its applications

16 Hrs

- Character table and their presentation
- Reduction formula for reducible representation of any matrix presentation of particular point groups
- Application of symmetry to hybrid orbital, molecular orbital
- Hybridisation schemes for sigma-orbitals (for AB_3 : planar triangle, trigonal pyramidal e.g. BF_3 & NH_3 , AB_4 : tetrahedral and square planar molecules e.g. CH_4 & $[PtCl_4]^{-2}$, AB_5 : trigonal bipyramidal & square pyramidal e.g. PCl_5 & IF_5 and AB_6 : octahedral e.g. SF_6 and pi-orbital for AB_3 (e.g. BF_3) AB_6 (e.g. SF_6).
- Application of symmetry to molecular vibrations, interpretation of IR & Raman activity. (spectral data)




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15.

UNIT 03 : Unifying principles of spectroscopy.

15 Hrs

Electromagnetic radiation, interaction of electromagnetic radiation with matter absorption, emission, transmission, reflection, refraction, polarisation and scattering, Uncertainty relation and natural line width and natural line broadening, transition probability, results of the time dependent perturbation theory, transition moment, selection rules, intensity of spectral lines, Born-Oppenheimer approximation, rotational, vibrational, and electronic energy levels.

UNIT 04 : Mossbauer spectroscopy

13 Hrs

- Introduction
- Interpretation of isomer shifts
- Quadruped interactions
- Paramagnetic Mossbauer Spectra
- Mossbauer Emission Spectroscopy
- Application 5



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M.Sc. (Chemistry) Semester - 1

Course: CHNN-405(A) (Elective course)
Computers for Chemists

CHNN -405 (A) Computers for Chemists

30 Hrs (2Hrs/week)

This is a theory-cum-laboratory course with more emphasis on laboratory work.

I Introduction to Computers and Computing

8Hrs

Basic structure and functioning of computers with a PC as an illustrative example.

Memory, I/O devices. Secondary storage. Computer languages. Operating systems with DOS as an example. Introduction to UNIX and WINDOWS. Data-Processing, principles of programming. Algorithms and flow-charts.

II Computer Programming in FORTRAN/C/BASIC

10Hrs

(The language features are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C and the features may be replaced appropriately). Elements of the computer language. Constants and variables. Operations and symbols. Expressions. Arithmetic assignment statement. Input and Output. Format statement. Termination statements. Branching statements such as IF or GO TO statement. LOGICAL variables. Double precision variables. Subscripted variables and DIMENSION. DO statement. FUNCTION and SUBROUTINE. COMMON and DATA statements. (Students learn the programming logic and these language features by 'hands on' experience on a personal computer from the very beginning of this topic).



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III Programming in Chemistry**12Hrs**

Development of small computer codes involving simple formulae in chemistry, such as van der Waals equation, pH 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, bond angles, dihedral angles etc. of molecules extracted from a database such as Cambridge database.

Books Suggested

1. Computers and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
2. Computational Chemistry, A.C. Norris.
3. Microcomputer Quantum Mechanics, J.P. Killingbeck, Adam Hilger.
4. Computer Programming in FORTRAN IV, V. Rajaraman, Prentice Hall.
5. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.




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M.Sc. (Chemistry) Semester - 1

Course: CHNN-405(B) (Elective course)

Computational Chemistry

I Fortran/C Programming and Numerical Methods

15 Hrs

Advanced programming features of FORTRAN/C. Basic theory, discussion of algorithms and errors for the following numerical methods. Examples from chemistry should be selected for illustrating the methods. The teacher may select ANY THREE of the following subtopics considering the background of students, available time etc.

a. Solution of Equations

Bisection, regular falsi, Newton ~ Raphson and related methods for solving polynomial and transcendental equations. Convergence. Errors and ill-conditioning.

b. Linear Simultaneous Equations

Gaussian elimination, Gauss-Seidel method, Gauss-Jordan method. Pivoting strategy. Errors and ill conditioning.

c. Eigenvalues and Matrix Diagonalization

Jacobi and Householder methods, analysis or errors.

d. Interpolation

Newton forward and backward difference, central differenced formulae. Lagrange and Hermite interpolation. Polynomial wiggle problem.

e. Numerical Differentiation

Solution of simple differential equations by Taylor series and Runge-Kutta methods.

f. Numerical Integration

Newton-Cotes formulae, Romberg integration, errors in integration formulae.

The students should develop computer programs for some of the above numerical methods.



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II Running of Advanced Scientific Packages**15 Hrs**

The students are expected to get hands on experience of running a few selected advanced level scientific software packages after a brief introduction to the basic theory and methodology. ab initio quantum chemical packages such as GAUSSIAN/GAMES with carefully designed exercises for illustrating various features of the packages.

Books Suggested

1. The Chemistry Mathematics Book, E. Steiner, Oxford University Press.
2. Mathematics for Chemistry, Doggett and Subliffe, Longman.
3. Mathematical Preparation for Physical Chemistry, F. Daniels, McGrawHill.
4. Chemical Mathematics, D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, JR. Barrante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.




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M.Sc. (Chemistry) Semester - 1
Course: CHNN-405(C) (Elective course)

Organic Spectroscopy

Unit - 1 : ^{13}C -NMR Spectroscopy

Introduction, Chemical Shift, Splitting of Signal, CMR Spectrum of Some Important Compounds Examples

Unit - 2 : MASS Spectroscopy

Basic Principle, Instrumentation and Applications of Mass Spectroscopy. IONIZATION METHODS, MOLECULAR ION PEAK (MIP), BASE PEAK, Isotope Abundance, ISOTOPE PAEAK METASTABLE ION PAK, FRAGMENTATION, Mass Spectrum of Some Important Compounds.

Unit - 3 : Problems Based on UV, IR, NMR and Mass Spectroscopy

REFERENCES

- Organic Chemistry by Morrison & Boyd
- Organic Spectroscopy by William Kemp
- Spectroscopic Techniques for Organic Chemists by James W. Cooper
- Spectroscopy of Organic Compounds by P. S. Kalsi
- Organic Structural Spectroscopy by Lambert, Sharvell, Lightner & Cooks
- Spectrometric Identification of Organic Compounds by Silverstein and Webster
- Organic Spectroscopy by V. R., Dani



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M.Sc. SEM – 1

Practical I

CHNN – 406 (Inorganic + Organic)

Qualitative and Quantitative Analysis

A. Less common metal ions—Ti, Mo, W, Ti, Zr, Th, V, U (two metal ions in cationic/anionic forms)

B. Insolubles - oxides, sulphates and halides

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS
2. Synthesis and Characterization of inorganic Compounds, W. L. Jolly, Prentice Hall
3. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
4. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A. Ft. Tatchell, John Wiley
8. Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman
9. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
10. Experimental Physical Chemistry, R. C. Das and B. Behera, Tata McGraw Hill.



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Organic Synthesis

- Acetylation: Acetylation of cholesterol and separation of cholesteryl acetate by column chromatography
- Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol
- Grignard reaction: Synthesis of triphenylmethanol from benzoic acid
- Aldol condensation: Dibenzal acetone from benzaldehyde
- Sandmeyer reaction: p-Chlorotoluene from p-toluidine
- Acetoacetic ester Condensation: Synthesis of ethyl-n-butylacetoacetate by A.E.E. condensation.
- Cannizzaro-reaction: 4-Chlorobenzaldehyde as substrate
- Friedel Crafts Reaction: B-Benzoyl propionic acid from succinic anhydride and benzene
- Aromatic electrophilic substitutions: Synthesis of p-nitroaniline and p-bromoaniline
- The Products may be Characterized by Spectral other Techniques

Quantitative Analysis

- Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method
- Estimation of amines/phenols using bromate bromide solution/or acetylation method
- Determination of Iodine and Saponification values of an oil sample.
- Determination of COD of water sample

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS
2. Synthesis and Characterization of inorganic Compounds, W. L. Jolly, Prentice Hall
3. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
4. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
5. Systematic Qualitative Organic Analysis, H. Middleton, Edward Arnold.
6. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clark, Edward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A. F. Tatchell, John Wiley
8. Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman
9. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
10. Experimental Physical Chemistry, R. C. Das and B. Behera, Tata McGraw Hill.



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SEM - I

Practical - II

CHNN - 407 Physical Chemistry

Error Analysis and Statistical Data Analysis

Errors, types of errors, minimization of errors, error distribution curves, precision, accuracy and combination; statistical treatment for error analysis, student 't' test, null hypothesis, rejection criteria, F & Q test; linear regression analysis, curve fitting.

Calibration of volumetric apparatus, burette, pipette and standard flask.

Adsorption

To study surface tension - concentration relationship for solutions (Gibbs equation).

Phase Equilibria

- (i) Determination of congruent composition and temperature of a binary system (e.g., Diphenylamine - benzophenone system)
- (ii) Determination of glass transition temperature of a given salt (e.g., CaCl_2) conductometrically.
- (iii) To construct the phase diagram for a three component system (e.g., chloroform - acetic Acid - water).

Chemical Kinetics

- (i) Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.
- (ii) Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar Media



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Electrochemistry

A. Conductometry

- (i) Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
- (ii) Determination of solubility and solubility product of sparingly soluble salts (e.g., PbSO_4 , BaSO_4) conductometrically.
- (iii) Determination of the strength of strong and weak acids in a given mixture conductometrically.

Potentiometry/pH metry

- I) Determination of strengths of halides in a mixture potentiometrically.
- II) Determination of the valency of mercurous ions potentiometrically.

Polarimetry

- (i) Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
- (ii) Enzyme kinetics - inversion of sucrose

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS
2. Synthesis and Characterization of inorganic Compounds, W. L. Jolly, Prentice Hall
3. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
4. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
5. Systematic Qualitative Organic Analysis, H. Middleton, Edward Arnold.
6. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clark, Edward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A. Ft. Tatchell, John Wiley
8. Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman
9. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
10. Experimental Physical Chemistry, R. C. Das and B. Behera, Tata McGraw Hill.



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