



**HEMCHANDRACHARYA NORTH
GUJARAT UNIVERSITY**

NAAC A (3.02) State University

PATAN-384265

Faculty of Science

M.Sc. Chemistry

Syllabus

Semester-III

W.E.F June-2020 (and thereafter)

CURRICULUM

Hemchandracharya

North Gujarat University,

Patan.

M.Sc. (Chemistry)

(WEF June: 2020)

General Information of Semester III & IV
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 voice 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-III & IV 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 via of forth 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 centre 40 (Organic branch) 25 for Inorganic & Physical branch, University Department.55 (Inorganic, Organic and Physical branches).
8. For semester III & IV
(A) The internal evaluation for total 120 marks will be done as per the continuous evaluation process as under.

	Marks
a) Weekly test of theory (minimum8)	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	<u>10</u>
	Total = 120
(B) SE Paper Internal Evaluation	<u>15</u>
	Total = 135

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

10. For semester III the papers, CHNN-601-(I), CHNN-602-(I), CHNN-603-(I), CHNN-604-(I), are core compulsory. Furthermore, students will have to choice any one of CHNN-605A-(I), or CHNN-605B-(I), Practicals CHNN-606-(I), & CHNN-607-(I).

11. For semester IV, the papers, CHNN-701-(I), CHNN-702-(I), CHNN-703-(I), and CHNN-704-(I), are core compulsory. In addition, the students will have to choice any one of CHNN-705A-(I), or CHNN-705B-(I), Practicals CHNN-706-(I), & CHNN-707-(I).

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

Note: During the preparation of this curriculum, samples are 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.

15. The mark distribution of 150 marks of practical will be as under from – (CHNN-606-(I), + CHNN-607-(I),M.Sc. SEM-III & CHNN-706-(I), + CHNN-707-(I),M.Sc. SEM- IV.

SECTION – I : 40 Marks

SECTION – II : 40 Marks

SECTION - III : 40 Marks

Viva : 30 Marks

Total: 150 Marks (Two full days)

Inorganic Chemistry

Hemchandracharya
North Gujarat University Patan
M.Sc. (Chemistry) (WEF June: 2020)
Semester-III

Work Load	Paper No.	Subject	External Marks	Internal Marks	Credit
60 Hrs.	CHNN-601-(I)	Inorganic Spectroscopy Paper-I	70	30	4
60 Hrs.	CHNN-602-(I)	Inorganic Chemistry Paper-II	70	30	4
60 Hrs.	CHNN-603-(I)	Inorganic Chemistry Paper-III (Corrosion) or Coordination Chemistry	70	30	4
60 Hrs.	CHNN-604-(I)	Inorganic Pharmaceutical and Medicinal Chemistry	70	30	4
30 Hrs.	CHNN-605A-(I)	Environmental Chemistry	35	15	2
30 Hrs.	CHNN-605B-(I)	Smart & Nanomaterials	35	15	2
90 Hrs.	CHNN-606- (I)	Practical- I	75	-----	3
90 Hrs.	CHNN-607- (I)	Practical- II	75	-----	3
Total			465	135	24

➤ **Working per semester minimum 90 days(15 weeks)**

M.Sc. Semester-III
Inorganic Chemistry Paper –I
(Inorganic Spectroscopy)
CHNN-601-(I)

Unit:- 1 E.S.R. & N.Q.R. Spectroscopy **25% (15 Hrs)**

- **E.S.R. Spectra of transition metal complexes**
Theory of E.S.R. (Basic principles). The presentation of E.S.R. Spectrum, Hyperfine splitting, Spin Hamiltonian, Applications.
- **N.Q.R. Spectroscopy:-**
Theory of N.Q.R. Origin of Transition, Experimental Techniques. Townes and Dailey's Formula, Structural Information from N.Q.R, Illustrated by suitable Examples.

Unit:- 2 X-ray Photoelectron Spectroscopy **25% (15 Hrs)**

- Application of
- (a) Valence-electron & photo-electron Spectroscopy
 - (b) X-ray photoelectron spectroscopy.

Unit:-3: Magneto Chemistry: **25% (15 Hrs)**

Principle & application of magneto chemistry: Basic (Diamagnetic, Paramagnetic, ferromagnetic, anti-ferromagnetic), Magnetic properties of free ions.

Unit:-4 Organo Metallic Compounds (OMC): **25% (15 Hrs)**

General Introduction & Principles. Factors governing the properties of OMC, General trends in Chemical Properties, Nature of metal-carbon Bond, Preparative methods, Reactions & applications.
Organo Aluminum & Beryllium Compounds, Organo boranes

Reference Books:

1. Spectroscopic Identification of Organic Compounds by R. M. Silverstein and F. X. Webster, 6th edition, John Wiley & Sons.
2. Introduction to Spectroscopy by D. L. Pavia, G. M. Lampman and G. S. Kriz, 3rd edition, Thomson Brooks/Cole.
3. Spectroscopic Methods in Organic Chemistry by D. H. Williams and I. Fleming, 4th edition, McGraw-Hill Book Company.
4. Organic Spectroscopy by William Kemp, 3rd edition, Palgrave.
5. Organic Spectroscopy-Principles and Applications by Jag Mohan, 2nd edition, Narosa Publishing House.
6. Spectroscopy of Organic Compounds by P. S. Kalsi, 5th edition, New Age International Publishers.

M.Sc. Semester-III
Inorganic Chemistry Paper –II
(Bio-inorganic & Organometallic Compounds)
CHNN-602-(I)

Unit:- 1 Bio-inorganic Chemistry **25% (15 Hrs)**

Introduction, The Biochemistry of iron, Iron Storage and Transport, Haemoglobin and Myoglobin, Cytochromes. Other Iron-Porphyrin Biomolecules, other Natural Oxygen Carriers, Iron-Sulphur Proteins.

Unit:-2 The Biochemistry of Transition metal **25% (15 Hrs)**

Zinc, Copper, Cobalt, Molybdenum and Tungsten Miscellaneous Other Elements: Vanadium, Chromium, Nickel.

Unit:-3 Organometallic Compounds **25% (15 Hrs)**

Organometallic Compounds & metal complexes as catalyst in Homogeneous & Heterogeneous Systems: Oxidative-addition, Reductive elimination. Migration (insertion) Reactions, Hydroformylation, Hydrogenation, Carboxylation.
Polymerization, Fisher-Trops Process, Water Gas Shift Reaction.

Unit:-4 Uranic Elements **25% (15 Hrs)**

Chemistry of Trans Uranic Elements:

Reference Books:

1. Organometallic Compounds, Vol.1 & 2 by G.E. Coates, M.L.H. Green and K. Wade, Methuen & Co. Ltd. London EC4.
2. Bioinorganic chemistry Gurudeep Chatwal
3. Inorganic chemistry, 45th Edition, James E Huheey and Ellen A Keiter.
4. Bioinorganic, Bioinorganic and Supramolecular Chemistry, P S Kalsi & J P Kalsi
5. Advanced Inorganic chemistry, 6th edition, Cotton and Wilkinson
6. Concise Inorganic Chemistry J.D Lee
7. Organometallic Compounds by G.E. Coates, John Wiley & Sons, Inc., New York.
8. Organometallic Chemistry by H. Zeiss, Reinhold Publishing Corporation, New York.
9. Organometallic Chemistry by R.C. Mehrotra & Anirudh Singh, New Age International (P) Limited, Publishers, New Delhi.
10. Progress in Inorganic Chemistry, Vol. 1 by F.A. Cotton, Interscience, Pub.Inc., New York.
11. Organotransition Metal Chemistry by John F. Hartwing, University Science Books, Sausalito, California.

M.Sc. Semester-III
Inorganic Chemistry Paper –III
(Corrosion)
CHNN-603-(I)

Unit:-1 Types of Corrosion **25% (15 Hrs)**

- a. Importance of Studying Corrosion.**
Electrochemical Mechanism- Type of Corrosion Damage, (Uniform Attack, Pitting, Dezincification, Intergranular Cracking).
- b. Corrosion Tendency And Electrode Potential:** The Oxygen Electrode and Differential Cell, Aeration Cell, Pourbaix Diagram, Emfiane Galvanic Series.

Unit:-2 Atmospheric Corrosion **25% (15 Hrs)**

- a. Polarization :** The polarized cell, How measured, Causes of polarization, Hydrogen over voltage, Influence of polarization on corrosion rate.
- b. Atmospheric Corrosion :** Types of atmospheres, corrosion product films. Factors influencing corrosivity of the atmosphere, Remedial measures.

Unit:-3 Underground Corrosion **25% (15 Hrs)**

- a. Underground Corrosion:** Factors Influencing The Corrosively of Soils, Pitting, Characteristics, Remedial Measures.
- b. Oxidation and Tarnish :** Theory e.g. of Oxidation, Wagner Theory of Corrosion. Oxidation resistant alloys.

Unit:-4 Corrosion & Cracking **25% (15 Hrs)**

- a. Stray Current Corrosion:** Sources of stray current Detection of stray current.
Method of Measuring the Resistivity of Soil, Effect of stray current on steel covered by concrete. Damage of sneep by SC.
- b. Stress Corrosion Cracking - Mechanism of cracking.**
Hydrogen Cracking - Mechanism of Cracking.
Corrosion Fatigue - Mechanism of Cracking.
Fretting Corrosion - Mechanism of Cracking.
Treatment of Water and Steam System. Hot and Cold Water Treatment, Boiler Water Treatment.

Reference Books:

1. Handbook of Industrial Chemistry, Vol.1 by K.H.Davis, F.S.Berner, CBS Publishers,Bangalore.
2. Comprehensive Coordination Chemistry, Chapter 57, 58.
3. Insight into Speciality Inorganic Chemicals, Chapter 15, by David Thompson, The Royal Society of Chemistry, 1995.
4. New Trends in Green Chemistry, 2nd Edition by V.K.Ahluwalia and M.Kidwai, Anamaya Publishers, 2007.
5. Pietro Pedefferri Corrosion Science and Engineering Springer ISBN: 9783030073800

M.Sc. Semester-III
Inorganic Chemistry Paper –III
(Co-ordination Chemistry)
CHNN-603-(I)

Unit:- 1 Theories of bonding: 25% (15 Hrs)

Theoretical principles of CFT, Introduction to spherical harmonics & the shape of d-orbitals, Derivation of crystal field potential for tetragonal, cubic and Square planar arrangement of ligands around central metal ion. Transformation of these potential from Cartesian to spherical harmonics. Effect of Voct on d^1 system. Evaluation of the various integrals involved. Solution of the secular determinant to obtain energies and corresponding wave functions, Crystal field splitting diagram for Oh, Td & Square planar systems.

Unit:-2 Theory of Electronic Spectra 25% (15 Hrs)

R.S Coupling & J. J. Coupling

Ladder operators :

- Step up & Step down operators and their use to obtain wave functions.
- Derivation and use of the equation.

$$X(\alpha) = \frac{\sin(1+1)\alpha/2}{\sin \alpha/2} = 2A_{2g}/3T_{1g}$$

Unit:-3 Weak Field Approximation 25% (15 Hrs)

The splitting of the free ion terms of d^2 in an oh field Calculation in weak field, approximation energy of the various terms; $2A_{2g}$, $3T_{2g}$, & $3T_{1g}$ derived from $3F(d^2)$ in an Oh field.

Strong field approximation :

Determination of multiplicities by the method of descending symmetry.

Calculation of energy of various terms within the frame work of strong field approximation.

Unit:-4 Electronic Spectra of Metal Complexes 25% (15Hrs)

Introduction, Selection rules, Vibronic coupling spectra of Ti(III), VO(IV), Ni(II), Co(II), Co(III), Fe(II), Fe(III), Cu(II), Mn(II) complexes under different geometries, Jahn-Tellor theorem.

Reference Books:

1. Advance Coordination Chemistry 1st Edition (English, Paperback, Shukla P R) Edition: 1st Edition, 2012 ISBN: 9789350515839, 9350515830
2. Inorganic Chemistry 3rd Edition 2008 by Donald A Tarr and Gary Miessler.
3. UGC Advanced Inorganic Chemistry (English, Paperback, Keemti lal, S.K. Agarwal) ISBN: 9789386306289, 938630628X

M.Sc. Semester-III
Inorganic Chemistry Paper –IV
“Inorganic Pharmaceutical & Medicinal Chemistry”
CHNN-604-(I)

Unit:- 1 Pharmacopocia and Monography: 25% (15 Hrs)

- (a) Pharmacopocia and Monography:
Electrolytes, major physiological ions, physiological acid-base balance, acid base imbalance, electrolytes used for replacement therapy, electrolytes used in combination therapy.
- (b) Gastro-intenstinal agents-Acidifying agents, gastric artacids, protective and adsorbents, saline cathartics
Antioxidants and buffers

Unit:-2 Respiratory System 25%(15Hrs)

- Expectorants and Emetics-Symptoms of Respiratory Disease
Expectorants, Antitussive and Emetics.
- (a) Topical agents- Protective, Astringents and Antimicrobials

Unit:-3 Role of Metal ions in Medicine 25%(15Hrs)

- Trace Elements- Copper, Iron, Iodine, Manganese, Zinc, Their Compounds and Their Relevance.
- (a) Metals in Medicine: Biomedical Significance. Role of Metal Ions in Drug Design Platinum Antitumor Agents-Discovery and Development, Synthesis.

Unit:-4 Medicinal Metal Complexes 25% (15 Hrs)

- (a) Vanadium Complexes- oxovanadium (IV) complexes for diabetes treatment
(b) Medicinal Applications of Metal complexes of N-Heterocyclic Carbenes (NHC)-NHC Precursors and Metal Complexes-Pyridine Based NHC Precursors and Metal Complexes, NHC Rhodium Complexes.

References:

1. A handbook of Inorganic Pharmaceutical Chemistry, Dr.K.G.Bothara, Nirali Prakashan.
2. Medicinal Inorganic Chemistry: American Chemical Society, Washington, DC
3. Medicinal Inorganic Chemistry: Orvig. C.Abrams, M.J.Ed., Chemical Reviews Vol.99, No.9, American Chemical Society, Washington, DC.1999.
4. Metallopharmaceuticals I & II, Clarke, M.J., Sadler, P., Eds, Springer, Verlag, New York, Inc.1999.
5. Uses of Inorganic Chemistry in Medicine, Farrell, N., Ed, Springer-Verlag, New York, Inc.1999.

M.Sc. Semester-III
Inorganic Chemistry Paper –V
(Environmental Chemistry)
CHNN-605-(A)
“SUBJECTIVE ELECTIVE”

Unit:- 1- Environmental Chemistry **50% (15 Hrs)**

Types of Water Pollutants: Organic, Inorganic, Radionuclids and their determination COD, BOD and Industrial Waste Water Treatment For Solids, Metals, Dissolved Organics and Inorganics.
Air Pollutants-CO, SO_x, NO_x, CFC, Hydrocarbon and Their Monitoring
Disposal of Hazardous Wastes.

Unit:- 2- Chemical and Bio fertilizers **50% (15 Hrs)**

Chemical Fertilizers, Applications, Adverse effects, Advantage of Bio fertilizers. Types of Mineral Fertilizers: Nitrogenous Fertilizers, Phosphoric and Potassium fertilizers, NPK grades.
Nitrogen bio fertilizer: Rhizobium(Symbiotic) Azetobactor(Non Symbiotic)
Phosphorus Bio fertilizer: P.S.B. phosphate solubilizing bacteria.

References:

- 1.Nanoparticles,buildings blocks of nanotechnology,Rotello V.Khwer Acad/ptenum publication, N.Y.2004
- 2.Nanoscale materials in chemistry-ed.by Klabunde K.J.John-wile,N.Y.2001
- 3.The chemistry of nanomaterials: Synthesis,properties and applications ed.by.C.N.Rao, A.Miller and A.K.Cheetham,wiley-VCH,2004
- 4.Nanotechnology, Richard Booker,Earl Boysen,Wiley
- 5.Environmental Chemistry,Akde,Wiley Eastern Ltd.
- 6.Environmental Chemistry,B.K.Sharma,H.Kaur,Goel Publishing House,Meerut.
7. Environmental Chemistry, B.K.Sharma,Goel Publishing House,Meerut.

M.Sc. Semester-III
Inorganic Chemistry Paper –III
(Advanced Industrial Inorganic Chemistry)
CHNN-605-(B)
“SUBJECTIVE ELECTIVE”

Unit:- 1- Nanomaterials in Chemistry **50% (15 Hrs)**

Introduction to Nanomaterials and Nanochemistry, Classification of Nanomaterials
General Methods of Preparation and Applications. Chemical and catalytic aspects of
Nanocrystals-Nanomaterials in catalysis, as adsorbents, as new chemical reagents.

Unit:- 2- Smart Materials **50% (15 Hrs)**

Ceramics, Alloys, Gels and Polymers. Piezoelectric Materials, Electrostrictive and
Magnetostrictive Materials, Rheological, Thermoresponve, pH sensitive Halochromic
Materials, Electrochromic Materials and Smart gels.

References:

1. Nanoparticles, buildings blocks of nanotechnology, Rotello V. Khwer
Acad/ptenum publication,
N.Y.2004
2. Nanoscale materials in chemistry-ed.by Klabunde K.J. John-wile, N.Y.2001
3. The chemistry of nanomaterials: Synthesis, properties and applications
ed.by.C.N.Rao, A.Miller and
A.K.Cheetham, wiley-VCH,2004
4. Nanotechnology, Richard Booker, Earl Boysen, Wiley
5. Environmental Chemistry, Akde, Wiley Eastern Ltd.
6. Environmental Chemistry, B.K.Sharma, H.Kaur, Goel Publishing House,
Meerut.
7. Environmental Chemistry, B.K.Sharma, Goel Publishing House, Meerut.

M.Sc. Semester-III
Inorganic Chemistry Paper –III
Practicals
CHNN-606-(I) & CHNN-607-(I)

1. Qualitative Analysis(Mixture of eight radicals, out of which two must be radical of less familiar elements W,Li,Th,V,Ce,Be,Ti,Mo)(Minimum-six)
2. Complexometric analysis of mixtures containing two components (at least four)
3. Water Analysis (Minimum Five)

Reference Books:

1. Qualitative Chemical semimicro analysis by V. N. Alexeyev, Mir Publishers Moscow.
2. Vogel's Qualitative Inorganic Analysis by G. Svehla, Orent Longman, New Delhi.
3. Vogel's Textbook of Quantitative Chemical Analysis, 5th edition by G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, ELBS Publication, 1996, Chapter 2, 3, 11.

Organic Chemistry

**Hemchandracharya
North Gujarat University Patan
M.Sc. (Organic Chemistry) (WEF June: 2020)
M.Sc. Semester-III**

Work Load	Paper No Course Code	Course Title Subject	External Marks	Internal Marks	Credits
60 Hrs.	CHNN-601-(O)	Natural Products	70	30	4
60 Hrs.	CHNN-602-(O)	Industrial Organic Chemistry	70	30	4
60 Hrs.	CHNN-603-(O)	Synthetic Drugs	70	30	4
60 Hrs.	CHNN-604-(O)	Selected Topics In Organic Chemistry	70	30	4
30 Hrs.	CHNN-605A-(O)	Green Chemistry	35	15	2
30 Hrs.	CHNN-605B-(O)	Photo Chemistry	35	15	2
90 Hrs.	CHNN-606-(O) Practicals	Organic Chemistry	75	-----	3
90 Hrs.	CHNN-607-(O) Practicals	Organic Chemistry	75	-----	3
		Total	465	135	24

➤ **Working per semester minimum 90 days (15 weeks)**

M.Sc. Semester-III
Organic Chemistry Paper –I
Natural Products
CHNN-601-(O)

Unit-1 Natural Coloring Matter: 25% (15 Hours)

Classification General Method of Structural Determination, Biosynthesis studies of Anthocyanine (Cyanin and Palargonidin, Flavones (Chrysin), Flavonols (Quercetin), Flavonone (Dihydro flavone) and Isoflavones (Daidzein), Coumarin, Quinones (Polyporic acid), Porphyrin. Chemistry of Hemin and Chlorophyll.

Unit-2 Terpenoids: 25% (15 Hours)

Chemistry of Abietic Acid, Gibberellic acid (Gibberellin-A), Squalene, Eudesmol, Phytol and Cadinene, Zingiberene, Biosynthesis study of Triterpenoid and Tetra terpenoid

Unit-3 Vitamins: 25% (15 Hours)

Detailed Study of Chemistry of Thiamine (Vitamin-B1), Pantothenic Acid (Vitamin-B2), Pyridoxine-(Vitamin-B6), Ascorbic Acid (Vitamin-C) Tocopherols (Vitamin-E), Biotin (Vitamin-H), and Biological importance of Vitamins.

Unit-4 Alkaloids: 25% (15 Hours)

General Biogenetic Studies of Alkaloids, Chemistry of Reserpine, Colchicine, Strychnine, Morpholine, Narcotine.

Basic Text & Reference Books:

1. Natural Products by O.P. Agarwal, vol. 1 & 2
2. Organic Chemistry of Natural Products by G.R. Chatwal, Vol. 1 & 2
3. The Chemistry of Natural Products, K. W. Bentley, Vol. I -V (Interscience).
4. Organic Chemistry, Vol. 2, I. L. Finar, 5th Edition (1994) ELBS Publication.
5. Natural Products Chemistry, Vol. I & II K. Nakanishi et al., Academic press publication (1974).
6. The Molecules of Nature, J. B. Hendrickson, W. A. Benjamin Inc. (1965).
7. Selected Organic Synthesis, Ian Fleming John Wiley (1977).
8. Chemistry of Natural Products, N. R. Krishnaswamy, University Press (India) Ltd. (1999).
9. Classical Methods in Structure Elucidation of Natural Products, Reinhard W. Hoffmann by Wiley-VHCA.

M.Sc. Semester-III
Organic Chemistry Paper –II
Industrial Chemistry
CHNN-602-(O)

Unit-1 Basic Principle of Unit Process & GMP, GLP: 25% (15 Hours)

Basic Chemical Data, Batch Versus Continuous Operation, Design Flowcharts, Chemical Process Selection, Safety Hazards, Fire and Toxic Materials, Research and Development, Patents. Good Manufacturing Practice and Laboratory Practice.

Unit Process and Unit Operations, Nitration, Halogenation, Animation, Sulphonation and Hydroxylation.

Unit-2: Soap, Detergents and Preservatives: 25% (15 Hours)

Detergents, Surfactants, Alkyl Benzenes, Fatty Acids and Fatty Alcohols, Soaps. Essential Oils, Constituents, Animal Fixatives, Fruit Concentrates, Vanilla, Chocolate, Monosodium Glutamate, Food Additives, Preservatives.

Unit-3: Oils, Fats & Agrochemicals: 25% (15 Hours)

Vegetable Oils, Cotton Seed Oil, Hydrogenation, Agrochemicals, Insecticides, Fungicides, Weedicides, Rodenticides, Plant Nutrients, Plant Hormones.

Unit-4 Pulp & Paper: 25% (15 Hours)

Pulp, Pulping Process, Sugar-Ethanol Industries Base Carboxyl Manufacture of Paper and Rayon.

Basic Text & Reference Books:

1. Industrial Chemistry By B.K Sharma
2. Unit Processes in Organic Synthesis. By P. H. Groggins
3. Shreves Chemical Process Industries By George T Austin
4. Industrial Organic Chemistry by Klaus Weissermann

M.Sc. Semester-III
Organic Chemistry Paper –III
Synthetic Drugs
CHNN-603-(O)

Unit-1: Drug Design & QSAR: 25% (15 Hours)

Introduction Naming of Organic Medicinal Compounds, Literature of Medicinal Chemistry, Classification of Drugs, Drug Design, Relation between Molecule Structure and Biological Activity (QSAR), Receptor Site Theory, Pharmacopies, Indian Standards, Modern Methods of Pharmaceutical Analysis, Diagnostic Agents, Pharmaceutical Aids: Solvents, Vehides, Flavors, Suspending Agents, Surfactants, Emulsifying Agents.

Unit-2: Antibiotics: 25% (15 Hours)

Classification, Synthesis and Activity of Penicillin, Cephalosporins, Streptomycin, Tetracycline's, Actinomycin, Chloramphenicol and Polyene.

Unit-3: Sulphadrugs: 25% (15 Hours)

Chemistry of Sulpha Drugs, Synthesis and Uses, Sulphanilamide, Sulphafurazole, Sulphaguanidine, Sulphathiazole, Sulphamerazine, Sulfalene, Sulfathiazole, Trimethoprim.

Unit-4: Miscellaneous Drugs: 25% (15 Hours)

Drugs Stimulating or Blocking The Peripheral Nervous System: Cholinergic & Anticholinergic Drugs, Histamine & Antihistamine, Local and General Anesthetics.

Basic Text & Reference Books:

1. Medicinal Chemistry by Ashutosh Kar
2. Medicinal Chemistry by G.R. Chatwal
3. Adhunik Sanslidh Aushadhi nu Rasayanvigyan / Anamik K.Shah. University Granth Nirman Board , Ahmedabad
4. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical, Chemistry, 11th Edition by John H. Block & John M. Beale, Published by Lippincott Williams & Wilkins (2004).
5. Principles of Medicinal Chemistry, 4th Edition by William O-Foye, Thomas L. Lemke and David A. Williams, Published in India by B. I. Waverly Pvt. Ltd. New Delhi (1995).

6. Essential of Medicinal Chemistry, 2nd Edition by Andrejus korolkovas, Published by Wiley-India Edition (1988).
7. Instant Notes: Medicinal Chemistry, Edited by Graham L. Patric, Published by Viva Books Private Ltd. (2002)
8. Textbook of Medicinal Chemistry Vol. I & II by V. Alagarsamy Published by Elsevier (2010).
9. Medicinal Chemistry 3rd Edition by Ashutosh Kar Published by New age international (P) Limited, Publishers (2005).
10. Medicinal Chemistry Edited by Alfred Burger Published by Interscience Publishers, John Wiley & Sons, New York (1951)
11. Burger's Medicinal Chemistry and Drug Discovery Vol. 3: Therapeutic agents Edited by Manfred E. Wolff Published by Interscience Publishers, John Wiley & Sons, New York (1996)
12. Burger's Medicinal Chemistry 4th Edition : Part III Edited By Manfred E. Wolff Published by Interscience Publishers, John Wiley & Sons, New York (1981)
13. Organic Chemistry, Vol. 2, I. L. Finar, 5th Edition (1994) ELBS Publication.
14. Natural Products Chemistry, Vol. I & II K. Nakanishi et al., Academic press publication (1974).
15. The Molecules of Nature, J. B. Hendrickson, W. A. Benjamin Inc. (1965).
16. Selected Organic Synthesis, Ian Fleming John Wiley (1977).
17. Chemistry of Natural Products, N. R. Krishnaswamy, University Press (India) Ltd. (1999).
18. Medicinal Chemistry by D. Shriram.
19. Synthetic Organic Chemistry O P Agarwal.
20. Synthetic Drug J J Trivedi & K A Thakar.
21. Synthetic Drug by Anamik Shah.

M.Sc. Semester-III
Organic Chemistry Paper –IV
Selected Topics IN Organic Chemistry
CHNN-604-(O)

Unit-1: Heterocyclic Chemistry-I **25% (15 Hours)**

Introduction of Heterocyclic Compounds, Nomenclature and Classification of Heterocyclic Compounds, Monocyclic Diheteroatomic Compounds (5 & 6 members) Synthesis and Chemical Reactivity of Pyrazole, Isoxazole, Isothiazole, Imidazole, Oxazole, thiazole.

Unit-2: Heterocyclic Chemistry-II **25% (15 Hours)**

Reaction and Synthesis of Bicyclic Heterocyclic Compounds Quinoline and Isoquinoline, Nucleophilic Substitution with Displacement of Halide, Reactions with Reducing Agents, Grignard's Reaction. Electrophilic substitution reactions of substituted Quinoline and Isoquinoline.

Synthesis of Quinolone: Skrap Synthesis, Knorr Synthesis, Isoquinoline: Bischner-Napieralski Synthesis, Heterocyclic System Containing Two Nitrogen Atoms: Synthesis of Cinnoline, Quinolone, Quinoxaline, Phthalazine.

Unit-3: Application of Oxidation Reagents: **25% (15 Hours)**

$\text{Na}_2\text{Cr}_2\text{O}_7$, KMnO_4 , CF_3COOH , MnO_2 , Ag_2CO_3 , NaIO_4 , SeO_2 , H_2O_2 , $\text{Al}(\text{O}-i\text{Pr})_3$, $\text{Al}(\text{O}-t\text{Bu})_3$

Unit-4: Application of Reduction Reagents: **25% (15 Hours)**

LiAlH_4 , $\text{Fe}+\text{HCl}$, NH_2NH_2 , BH_3 , NaBH_4 , $\text{NaBH}_4+\text{CeCl}_3 \cdot 7\text{H}_2\text{O}$, Pd/H_2 , Ni/H_2 , Pt/H_2 , Diisobutyl Aluminum Hydride(DIBAL-H), Sodium Cyano Borohydride and Sodium triacetoxy Borohydride,

Basic Text & Reference Books:

1. Heterocyclic Chemistry II Volume I,II, III R R Gupta, M Kumar, V Gupta, Springer R. K. Bansal
2. Modern Methods of Organic Synthesis 4th Edition by W. Caruthers, Iain Coldham
3. Heterocyclic Chemistry, 4th Edition by J. A. Joule & K. Mills, Published by Chapman & Hall (1995)

4. Principles of Modern Heterocyclic Chemistry, Edited by Leo A. Paquette, Published by Pearson Benjamin Cummings (1968)
5. Heterocyclic Chemistry, 3rd Edition by Thomas L. Gilchrist, Published by Prentice Hall (1997)
6. The Structure & Reactions of Heterocyclic Compounds, Edited by Michael Henry Palmer, Published by Edward Arnold (1967)
7. Heterocyclic Chemistry by V. K. Ahluwalia, Narosa Publishing House.

M.Sc. Semester-III
Organic Chemistry Paper –V
Green Chemistry
CHNN-605-(A)
(Subject Elective)

Unit-1: Green Chemistry-1: 50% (15 Hours)

Green Chemistry Definition and Introduction, Need for Green Chemistry, Metathesis: A Classical Example of Green Chemistry, Principal of Green Chemistry, Green Chemistry in India , Green Guidelines Used in Laboratory, Green Chemistry in Everyday life.

Unit-2: Green Chemistry-2: 50% (15 Hours)

Tools of Green Chemistry, Green Starting Materials, Green Catalysts, Green Reactions, Green Solvents, Ionic Liquids, Green Reaction Conditions, Green Chemical Products, Reactions in Solid Phase, Catalysis, Biocatalysts and Phase Transfer Catalyst, Use of Renewable Feed Stock, Energy Efficiency, Green Chemistry Practices, Organic Preparations, Synthesis of Green Reagents.

Basic Text & Reference Books:

1. Green Chemistry Gurtu Gurtu Pragati 1st Edition 2012 ISBN:93-5006-655-6

M.Sc. Semester-III
Organic Chemistry Paper –V
Photo Chemistry
CHNN-605 (B)
(Subject Elective)

Unit-1: Photochemistry & Photochemistry of Alkenes: 50% (15 Hours)

Introduction of Electromagnetic Radiant with Matter, Law of Photochemistry, Fate of Excited Molecule, Types of Excitations, Transfer of Excitation Energy, Quantum Yield / Quantum Efficiency, Photolytic Cleavage, The fate of Excited Molecule, Physical and Chemical Process, Intermolecular Reactions of the Olefinic Bond, Geometrical Isomerism, Cyclisation Reactions, Rearrangement of 1,4 and 1,5 dienes.

Unit-2: Photochemistry of Carbonyl & Aromatic Compounds
50% (15 Hours)

Norrish Type-1 α -Cleavage Reaction, Norrish Type-2 Reaction, Intermolecular Reactions of Carbonyl Compounds Saturated Cyclic and Acyclic, β - γ , unsaturated and α - β , Unsaturated Compounds, Cyclohexanones, Intermolecular Cycloaddition Reactions Dimerization and Oxetane Formation, Isomerization, Additions and Substitutions, Di- π Methane Rearrangement.

Basic Text & Reference Books:

1. Fundamentals of Photochemistry K.K. Rohatgi-Mukherjee, Wiley Eastern
2. Essentials of Molecular Photochemistry Agillbertandj Baggott Blackwell Scientific
3. Molecular Photochemistry N.J Turro W A Benjamin.
4. Introductory Photochemistry ACox andTCamp McGraw-Hill
5. Photochemistry, R.P Kundall and A.Gillbert Thomson Nelson
6. Organic Photochemistry J. Coxon and Balton Cambridge University Press.
7. Environmental Chemistry H Kaur Pragati 8th Edition 2014 ISBN:978-93-5140-060-8
8. Vogel's Textbook of Practical Organic Chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (Pearson Education)
9. Comprehensive Practical Organic Chemistry: Preparation and Quantitative analysis, V.K. Ahluwalia, Renu Aggarwal (Universities Press)

M.Sc. Semester-III
Organic Chemistry Practical
CHNN-606-(O) & CHNN-607-(O)

1) Organic Separation:

Separation, Purification and Identification of three Compounds (Ternary Mixture) 10 grams Organic Mixture by Semi Micro Method- Preparation of Derivative. (Minimum Five Mixtures should be done).

2) Organic Estimation (Semi Micro Methods):

1. Estimation of Penicilline
2. Estimation of Amino acids
3. Estimation of Sulphadrugs
4. Estimation of Enol group
5. TLC of Dyes

Organic Preparation:

Two & Three stage preparation from 4 & 5 grams starting materials (semi micro method) Minimum five should be done including name reactions.

Basic Text & Reference Books:

1. Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (Pearson Education)
2. Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia, Sunita Dhingra (Universities Press)
3. Organic structures from spectra, 5th edition, L. D. Field, S. Sternhell, J. R. Kalman (Wiley: A John Wiley & Sons Ltd publication)
4. Elementary Organic Spectroscopy: Principles and Chemical applications (revised edition), Y. R. Sharma (S. Chand Publishing)

Physical Chemistry

**Hemchandracharya
North Gujarat University, Patan
M.Sc. (Physical Chemistry) (New Syllabus WEF June:2020)
M.Sc. Semester-III**

Work Load	Paper No Course Code	Course Title Subject	External Marks	Internal Marks	Credits
60 Hrs.	CHNN-601-(P)	Physical Chemistry	70	30	4
60 Hrs.	CHNN-602-(P)	Physical Chemistry	70	30	4
60 Hrs.	CHNN-603-(P)	Physical Chemistry	70	30	4
60 Hrs.	CHNN-604-(P)	Physical Chemistry	70	30	4
30 Hrs.	CHNN-605A-(P) (SE)	Physical Chemistry	35	15	2
30 Hrs.	CHNN-605B-(P) (SE)	Physical Chemistry	35	15	2
90 Hrs.	CHNN-606-(P) Practicals	Physical Chemistry	75	-----	3
90 Hrs.	CHNN-607-(P) Practical	Physical Chemistry	75	-----	3
		Total	465	135	24

➤ **Working per semester minimum 90 days (15 weeks).**

M.Sc. SEMESTER-III

Physical Chemistry

CHNN-601(P)

Paper-I

Unit-1 Photo Chemistry

25% (15 Hours)

Basics: Einstein law, laws of Photochemistry (Grothus law, -Draper law, Bunsen-roscoe's, law of photochemical equivalence, Plotnikov law), quantum yield, Deviation from photochemical equivalence, (Reasons of high and low yield), experimental methods for determination of quantum yield, factors affecting quantum yield.

Photochemical kinetics: Rate constants of reactive energy states, life times of reactive energy states, seat of photochemical reactions, Determination of rate constants of reactions, effect of light intensity on the rate of photochemical reaction, photo reaction which do not involve chain reaction and reactions which involve chain reaction.

Photochemical reaction: types and classification of photo chemical reaction, photooxidation, photo oxygenation, photo fragmentation, photo dissociation, photo isomerisation and photo reduction,

Environmental photochemistry: photo dissociation of oxygen, photo oxidation of proteins, formation of smog, thermo luminescence, phonophoresis, photochemical inhibition, photo reduction of dyes by two electron transfer process.

Unit 2: Adsorption

25% (15 Hours)

Isotherm: Chemical & physical adsorption isotherm, Freundlich, Langmuir and BET adsorption equation, Gibb's adsorption isotherm, Temkin adsorption isotherm.

Experimental Adsorption Measurements: methods for surface area, Measurement of adsorption isotherm (Experimental), determination Enthalpy and heat of adsorption

Films: Structure of surface films, Status of monomolecular surface films and their advantage, Types of insoluble films, Gaseous films and continues film.

Application: Detergency and Adsorption and Homogeneous/ Heterogeneous catalysis, Adsorption and indicators, adsorption and Water (softening, deionization, electrical demineralization).

Unit: 3 Solid state chemistry**25% (15 Hours)**

Solid: Type of solids, Difference between crystalline solid and Amorphous solid, close packing perfect and imperfect crystals, intrinsic and extrinsic defects, point defects, line and plane defects. Schottky and Frenkel defects, consequences of stoichiometric defects,

Crystal Growth: Factors affecting the shape of growing crystal, crystal growth and Techniques of single crystal growth.

Conductorone theory of solids. Super conductors, upper conductors of type I and II BCS theory of superconductors, Messner's effect.

Solid state reactions: General principles, experimental procedures, co-precipitation as a precursor to solid state reaction, kinetics of solid-state reaction.

Unit: 4 Phase Equilibrium**25% (15 Hours)**

Phase, components, degree of freedom, condition for equilibrium between phases, The Gibb's phase rule, Derivation of the phase rule, One-component system, The water system, The carbon dioxide system, The sulphur system, Some typical solved examples for One-component System, The liquid helium system, High pressure phase diagrams, The water system, the carbon system, Two-component system, Type A simple eulectic systems, Thermal analysis: cooling curves, Lead-silver system, Bismuth-Cadmium System, potassium iodide-water system, Representation of triangular plot, Partially miscible ternary liquid system, Experimental methods used for Obtaining triangular, Phase transition-second order, Exercises.

Books:

1. Fundamentals of Photochemistry, R.K. Rohatgi and Mukherji, Tata McGraw Hall,
2. Essentials of Photochemistry, A. Gilbert and J. Baggott, Black well Scientific publishers.
3. Introductory Photochemistry, A. Cox and T camp, Mac Graw Hill.
4. Organic Photochemistry, J. Coxon and Hilton, Cambridge University Press.
5. Physical Chemistry, A.W. Atkin, ELBS
6. Advanced Physical Chemistry, Gurdeep Raj, Himalayan Publication 1997.
7. Solid State Chemistry and its Applications, A.R. West, john Wiley & Sons, New York (1984)

8. Solid state chemistry , D. K. Chakrabarty, New Age Int. Pub., New Delhi,(2009)
9. Atomic Structure & chemical bond, Manas Chandra, Tata McGraw Hill, (1995)
10. Treatise on solid state chemistry Vol I, VII, B.N. Haney, Plenum Press, (1975)
11. Introduction to solids, L.V. Azaroff, Mc Graw Hill, (1960) S
12. The Crystal as A Super molecular Entity: Perspectives in Super molecular Chemistry, G.R. Desiraju, Wiley-VCH (1996)
13. Advanced physical chemistry by Gurtu n Gurtu
14. Principle of physical chemistry by Puri Sharma Pathania.
15. Advanced physical Chemistry By Gurdeep Raj.

M.Sc. SEMESTER-III
Physical Chemistry
CHNN-602(P)
Paper-II

Unit 1:

25% (15 Hours)

Reversible Cells: reaction in Reversible cells, Free Energy and heat changes in reversible cells, Amalgam cells, Activity coefficients from cells with transference, Quinine- hydroquinone system, Two stage oxidation reduction.

Liquid Junction : Liquid junction potentials of same electrolytes, General equation of liquid junction potential, Types of boundary, free diffusion junction , flowing junction , constrained diffusion junction

Electrolytic Conduction: Mechanism of electrolytic conductance (Debye Huckel Onsager Conductance equation) validity of DHO equation (Aqueous & non aqueous solution), Deviation of DHO Equation, Debye Falkenhagen effect and Wien effect,

Migration of ions: Transference number (True, apparent & Abnormal), Transference numbers in mixture, Factors effecting transference numbers, Methods for determining transference numbers.

Unit 2:

25% (15 Hours)

Acids and Bases: Types of solvents, Dissociation constant, determination of dissociation constants of mono and poly basic acids by E.M.F. methods, colorimetric methods and conductimetric methods,

Effect of solvent on dissociation constant, Determination of ionic product of water by conductometric method and E.M.F. method.

Amphoteric electrolytes: properties of Dipolar ions, E.M.F methods for determination of dissociation constant of amino acids, proportion of dipolar ions, isoelectric point.

Neutralization curves for ampholytes, activity coefficient of ampholytes.

Unit 3:

25% (15 Hours)

Over voltage: Theories of Hydrogen Overvoltage (Bubble formation, Combination of atoms as slow process, ion Discharge as the process, proton

transfer as the slow process), Factors effecting overvoltage, oxygen overvoltage, hydrogen overvoltage.

Polarisation: Electrolytic polarisation, Dissolution and decomposition potentials, metal deposition, concentration polarisation, Decomposition voltage in aqueous solution, Metal dissolution.

Reversible Oxidation and Reduction: Reversible Oxidation and Reduction process, nonreversible process, Factor effecting electrolytic reduction and electrolytic oxidation, Application of electrolytic oxidation and reduction.

Electro Organic Synthesis: complete cell design designer electrodes, polymerization of anions, Oxidation of Fatty acids, Brown-walker Electro synthesis.

Unit 4: 25% (15 Hours)

Electrophoresis and electro chromatography: principle, types, instrumentation and applications, capillary electrophoresis: Basic, Principle, instrumentation & Application.

Coulometry and amperometry: Basic, instrumentation & Application.

Polarography: Principle, wave equations, instrumentation & Application.

Voltametry (Cyclic Voltametry, Andodic stripping).

Books:

1. Modern Electrochemistry, J OM Bockeris/A.K.N. Reddy, Vol.1 and 2, third edition, plenum press,1977
2. Modern Electrochemistry, J OM Bockeris/A.K.N. Reddy, Vol.1,2 and 3, second edition, Springer,2008.
3. An introduction to electrochemistry, Samuel Glasstone, 10th edition, D. van Nostrand company, INC.1962
4. Erving's Analytical instrumentation hand book, edited by Jack cazes, Third edition, instrumental method of chemical analysis, Galen W. Ewing, Fourth edition, Mac Graw hill 1975.

M.Sc. SEMESTER-III
Physical Chemistry
CHNN-603(P)
Paper-III

Unit 1: Introduction to Polymer **25% (15 Hours)**

History, Classification on the Basis of Use and Chemical structure and geometrical structure, degree of Polymerization, Polydispersity, Average Molecular weight and molecular weight distribution, molecular Forces and chemical Bonding in Polymers.

Structure and Property relationship in fibres, elastomers and fibres

Naturally occurring polymers (Rubber, Asphaltenes, Shellac, Cellulose, Starch, Proteins, Nucleic acid, silk, wool)

Synthetic polymers (Buna S, Buna N , Thiokol, Rayon, Polyester Fibres, Inorganic and partially inorganic polymers)

Unit 2: Physical Properties of Polymers **25% (15 Hours)**

Force in polymers: Molecular forces and bonding in polymers (primary and secondary forces), intermolecular forces and physical properties (volatility and molecular weight, miscibility and solubility),

Polymer structure and physical property: Crystalline melting point, properties involving small deformations, properties involving large deformations,

Glass Transition Temperature: Definition of Glass Transition Temp. (state of Aggregate & state of phase), Secondary glass transition temp. (state of Aggregate & state of phase), Secondary glass transition temperature, Factors effecting T_g, Relation Between T_m & T_g, The WLF equation, Methods for determination of Glass Transition Temp.

Unit 3: Mechanism and Kinetics of polymerization **25% (15 Hours)**

Chain polymerization: Mechanism and Kinetics of Free Radical, Cationic & Anionic chain Polymerization,

Co-ordination polymerization: Ziegler –Natta Catalyst, Mechanism Of Ziegler-Natta polymerization (mono-metallic & Bio-metallic), early Kinetics models for Ziegler-Natta catalyst, Active centre.

Step Polymerization: Mechanism of step Polymerization, Polyfunctional step polymerization. Kinetics of Linear polycondensation polymerisation (Acid catalysed & Noncatalyzed) Ring opening Polymerisation: of cyclic ethers and cyclic amides.

Unit 4: Polymer Reactions

25% (15 Hours)

Polymer degradation: Types of degradation, photo degradation, Mechanical degradation, Thermal degradation, oxidation degradation, Hydrolytic degradation.

Polymer Reactions: Acidolysis, Amino lysis, Addition, Substitution, Crosslinking and cyclisation Reaction.

Polymer solution: criteria of polymer solubility, conformations in polymer chains in solution, Entropy and heat of mixing of polymer solutions, phase equilibrium in polymer solutions.

Books:

1. Polymer chemistry: An introduction by Malcom P. Stevens, Indian edition, Oxford university press, London, 2011.
2. Introductory polymer chemistry, G.S. Mishra, New Age international LTD. Publishers, 2008.
3. Text book of polymers science, Fred W. Bill Meyer, a Wiley inter cience, Canada, New Delhi.1984.
4. Advanced polymer chemistry, manas Chandra, Marcell Dekker, New York,2000.
5. Speciality polymers, R.W. Dyson, Blackie Academic and professional, London1998.
6. Polymer science, V.R. Gawarikar, N.S. Viswanathan and J. Sreedhar, Wiley eastern.
7. Physical and Chemistry of Polymers J.M.G. Owe, Blackie Academic and professional.
8. Functional monomers and polymers, K. Takemotto, Ontabritte.

M.Sc. SEMESTER-III

Physical Chemistry

CHNN-604 (P)

Paper-IV

Unit 1: Mass Spectrometry **25% (15 Hours)**

Introduction ion production E1, C1 FD, ESI and FAB, factors affecting fragmentation, ion analysis, ion abundance, Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, meta stable peak. Me Lafferty rearrangement, nitrogen rule, High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect to their structure Determination.

Unit 2: X-ray Diffraction **25% (15 Hours)**

Principle, Theory-X-ray spectral lines, X-ray tube emission, Bragg condition, Miller Indices, Laue method, Bragg Method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, structural of simple lattices, X-ray intensities, structure factor and its relation to intensity, structure factor and electron density, chemical analysis using X-ray absorption, X-ray Fluorescence, chemical analysis, X-ray diffraction, Numerical problems.

Unit 3: The Liquid State & liquid crystals **25% (15 Hours)**

The gaseous, liquid and solid state, the vacancy theory of liquid, the free volume of a liquid, physical properties of liquid, vapour pressure, surface tension, the Kelvin equation for vapour pressure of a droplet, Excess pressure in a drop, the Laplace equation and the Young-Laplace equation, surface active agents, viscosity, effect of temperature on viscosity, the Reynolds number, Molar refraction, Optical activity, ORD and CD, Structure of Liquids, Questions. Liquid Crystals, Vapour Pressure – Temperature diagrams, Thermography, LCDs and the seven segment cell, Nometric, liquid crystals, cholesteric liquid crystals, Disc shape liquid crystals, Polymorphism in thermotropic liquid crystals, pressure-induced mesomorphism, Molecular arrangements in various states of liquid crystal, Questions.

Unit 4: Photo electron & Photo acoustic spectroscopy **25% (15 Hours)**

Introduction, principle, Instrumentation and application of following technique, Photo acoustic spectroscopy(PAS), photo electron spectroscopy, Koopman's THEROM,esca Andchemical information obtianded rom it, Augerelectron Spectroscopy(AES)

Books:

1. Spectroscopic method in Organic chemistry. Forth edition D. M. Williams and I.Fleming Tata-McGraw Hill, New Delhi, 1990.
2. Organic spectroscopy, Second Edition, W. Kemp, ELBS Macmillan,1987
3. Application of absorption spectroscopy of Organic Compound J. R. Dyer, Prentice Hall of India, New Delhi, 1984.
4. Spectroscopic identification of Organic Chemistry. Forth Edition R.M.
5. Spectroscopic Methods in Organic Chemistry. Forth Edition D.M. Williams and I. Fleming Tata –McGraw Hill, New Delhi,1990.
6. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, Instrumental methods of Analysis, HCBS Publishing new Delhi;2004, 7th Ed.
7. C.N. Banwell and E.M. McCosh, Fundamentals of Molecular Spectroscopy, Tata –McGraw Hill, New Delhi; 4th Ed.
8. R.M. Silverstein, F.X. Webster; Spectroscopic identification of Organic compounds; Wiley-India; 6th Ed.
9. P.S. Kalsi; Spectroscopy of Organic compound; New Age International; 2Ed.
10. Principle of Physical chemistry. Puri Sharma Pathania.
- 11.Spectroscopic methods in Organic chemistry4th edition D.M Willaiams an L Fleming Tata MaGraw Hill, New Delhi 1990.

M.Sc. SEMESTER-III
Physical Chemistry
CHNN-605 (P)-(A)-SE

Unit 1: **50% (15 Hours)**

(A) Atomic Absorption Spectroscopy

Introduction, Principle, Grotrian Diagrams, Detection of Non-metals by Atomic Absorption Spectroscopy, Difference Between Atomic Absorption Spectroscopy and Flame Emission Spectroscopy, disadvantage of atomic absorption spectroscopy, Instrumentation, Operation of Atomic Absorption Spectrometer, Single and Double beam Atomic Absorption Spectrometer, Detection Limit and Sensitivity.

(B) Flame Photometry

Introduction, Limitation of Flame Photometry, General principle of Flame Photometry, Instrumentation, Effect of Solvent in Flame Photometry, Instruments, Application of Flame Photometry, Limitation of Flame Photometry.

Unit 2: **50% (15 Hours)**

(A) Conductometric Measurements

Introduction, Some Important Laws, Definition and Relations, Effect of dilution, Conductance Measurements, Application of Conductance Measurements, Types of Conductometric Titrations, Advantage of Conductometric Titrations, Disadvantage of Conductometric Titrations.

(B) Measurement of pH

Introduction, Determination of pH, Ion selective electrode, Instrumentation, Application of pH Measurement.

(C) Potentiometric Titration

Introduction, Instrumentation, Types of Potentiometric Titration, Variation in Potentiometric Titration, Advantage of Potentiometric Titration.

Book:

1. Instrumental Methods of Chemical Analysis by Gurdeep R Chatwal, Sham K Anand Himalaya Publishing House.

M.Sc. SEMESTER-III
Physical Chemistry
CHNN-605 (P)-(B)-SE

Unit 1: The Gaseous State (Ideal Gases): **50% (15 Hours)**

The Kinetic Molecular Theory of gases, Pressure Of an Ideal Gas, Derivation of the gas laws, The ideal gas , equation, Kinetic energy and temperature, The Maxwell distribution Of molecular velocities, The Maxwell distribution Of molecular energies, Types of molecular velocities, Derivation of expression for molecular velocities, Expensive and compressibility, collision parameters, collision diameter, collision cross section, collision number, collision frequency, Mean free path, Transport Properties, thermal conductivity, Viscosity, Diffusion, Summary of transport properties in a gas, the degree of freedom of a gaseous molecules, the principle of equipartition of energy, Contribution to heat capacity of an ideal gas, The Barometric Formula, Questions and answers.

Unit 2: The Gaseous State (Real Gases) **50% (15 Hours)**

Deviation of real gases from ideal behaviour, Explanation of deviation, Equation of state for real gases, The Vander Waal equation of state, Other equation of state, The virial equation of state, intra molecular forces, The Lennard – Jones (6-12) Potential, The second virial coefficient, the critical phenomena, P-V isotherm of carbon dioxide, The Vander Waal equation and critical state, Molar Mass and Density of real gas, Liquefaction of gas, Production of low temperatures by adiabatic demagnetization, Question and Problems.

Book:

1. Principle of Physical Chemistry By Puri Sharma Pathania.
2. Advanced physical Chemistry By Gurdeep Raj.

M.Sc. SEMESTER-III
Physical Chemistry- Practicals
CHNN-606-(P) & CHNN-607-(P)
Section –I (Minimum-05)

1. Determination of molecular radius of molecule of a molecule (organic liquid) using Refractometer.
2. Determine Molar refractin of methyl acetate, ethyl acetate, n-hexane & CCl₄. Calculate the atomic reflactiion if C, H and Cl atoms.
3. Determine heat of transition and transition temperature for sodium sulphate decahydrate by thermometric methods.
4. Study the varitation of surface tention of solution of n-propyl alcohol with concentration and hence determine the limiting cross sectional area of alcohol molecule.
5. Titration of KI solution against HgCl₂ solution conductometrically.
6. Study the variation with composition of mixture of
 - a. Ethanol – Water, b. Methanol- ethylene diamineDetermine whether there is complex compound formation between two layers.
7. Determine the radius of molecule of sucrose by viscosity measurement.
8. Investigate solubility of component system & hence draw a tie line on binodal.
9. Separation of mixture of methylene blue Fluorescein on alumina column.
10. Separation of amino acids/proteins by electrophoresis.
11. Determine the ionzation constant of a weak acid (say Acetic acid) by conductometry.
12. Determine the strength of weak acid (CH₃COOH) by titrating it with a weak base (NH₄OH) conductometrically.
13. To study the effect of electrolytes on water structure by viscosity method.

Section –II (Minimum-05)

1. To Study the Influence of ionic strength on solubility of CaSO₄.
2. To Determine the isoelectric point of glycine by pH metric.
3. Determine the standard electrode potential of Ag/Cu/Pb/Zn.
4. Estimate Na⁺ or K⁺ ion by flame photometer.
5. Separation of dyes TLC (any two)

Malachite green	Alizarin
Crystal violet	Methyl Orange

Cresol Red	Congo Red
Fast green	Sunset Yellow
Rhodamine B	Pela Red

6. Determine velocity constant, order of reaction, energy of activation for saponification ethyl acetate by sodium hydroxide conduct metrically.
7. Determination of solubility of Lead sulphate/ barium sulphate conduct metrically,
8. Determination of CMC and ΔG of sodium dodecyl sulphate conduct metrically.
9. Polarographic determination of Pb^{+} , Cd^{2+} , or Cu^{2+} ions.
10. Fluorimetric determination of Al^{3+} , Cd^{3+} , Ca^{2+} or Zn^{2+}
11. To determine the Normality and Dissociation Constant of the given acid by Potentiometry.
12. To determine the equilibrium constant for the reaction between Ag^{+} and NH_3 by Potentiometry.

Section –III (Minimum-05)

1. Investigation the reaction between iodine and acetone.
2. Study Kinetics between potassium persulphate and potassium iodide by differential method.
3. To determine the solubility of Calcium in Presence of different concentration of KCl/HCl.
4. Investigation the complex ion formation between Fe(III) and thiocyanate ion by job's method using spectrophotometer and find out (i) free energy (ii) stability constant
5. Determine the composition of the following binary mixtures by using spectrophotometer or Colorimeter following Additives rules (any Two)
a) $COCl_2 \cdot 2H_2O + NiCl_2 \cdot 6H_2O$, b) Crystal violet + Aurine c) $K_2Cr_2O_7 + KMnO_4$
6. Determine the concentration of Fe (III) solution by titration with EDTA spectrophotometrically.
7. Spectrophotometric determination of lead on Leaves using solvent extraction.
8. Determination inorganic phosphorus in human urine or serum spectrophotometrically.
9. Spectrophotometric titration of copper and Bismuth mixture by EDTA.
10. Construct the phase diagram for three component system (chloroform-acetic acid-Water).
11. To determine the concentration and dissociation constant of a given di-basic acid by pH metric titration.
12. To determine the acidic and basic dissociation constant of a given amino acid and its isoelectric point by pH metry.