

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Programme code :		Programme Name :	B.Sc.
Faculty :	SCIENCE	Semester :	V
Subject :	CHEMISTRY		
Effective from :	June 2022 એ		

Sr.	Paper Code	Name of Paper	Credit
1	CC CH-501	INORGANIC CHEMISTRY-I	3
2	CC CH-502	ORGANIC CHEMISTRY-II	3
3	CC CH-503	PHYSICAL CHEMISTRY-III	3
4	CC CH-504	STRUCTURAL -ANALYTICAL CHEMISTRY-IV	3
5	SE CH -505 A	SYNTHETIC DYES	2
	SE CH -505 B	SPECTROPHOTOMETRY	
6	GE CH 506	ELECTIVE (GENEIC) COURSE	2
7	LC CH-507 A	LABORATORY COURSE-I INORGANIC CHEMISTRY PRACTICALS	1.5
	LC CH-507 B	LABORATORY COURSE-II ORGANIC CHEMISTRY PRACTICALS	1.5
	LC CH-507 C	LABORATORY COURSE-III PHYSICAL CHEMISTRY PRACTICALS	1.5
	LC CH-507 D	LABORATORY COURSE-IV VIVA -VOCE	1.5

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Programme code :		Programme Name :	B.Sc.
Faculty :	SCIENCE	Semester :	VI
Subject :	CHEMISTRY		
Effective from :	June 2022 २१		

Sr.	Paper Code	Name of Paper	Credit
1	CC CH-601	INORGANIC CHEMISTRY-I	3
2	CC CH-602	ORGANIC CHEMISTRY-II	3
3	CC CH-603	PHYSICAL CHEMISTRY-III	3
4	CC CH-604	STRUCTURAL -ANALYTICAL CHEMISTRY-IV	3
5	SE CH -605 A	POLYMER CHEMISTRY	2
	SE CH -605 B	ELECTRO ANALYTICAL TECHNIQUES	
6	GE CH 606 A	ELECTIVE (GENEIC) COURSE	2
7	LC CH-607 A	LABORATORY COURSE-I INORGANIC CHEMISTRY PRACTICALS	1.5
	LC CH-607 B	LABORATORY COURSE-II ORGANIC CHEMISTRY PRACTICALS	1.5
	LC CH-607 C	LABORATORY COURSE-III PHYSICAL CHEMISTRY PRACTICALS	1.5
	LC CH-607 D	LABORATORY COURSE-IV VIVA -VOCE	1.5

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

University Road, P.O.BOX NO: 21, PATAN-384265

N. Gujarat. INDIA.

NAAC Accreditation Grade – “B”

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FACULTY OF SCIENCE

CHEMISTRY SYLLABUS

(Effective from June-2022)

B.Sc. (semester V & VI Programme)

The proposed new courses in chemistry for under graduate classes are reassigned in accordance to semester/CBCS/Grading system with new education policy. The new course is based on model curriculum of the university grants commission.

The medium of instruction should be Gujarati and the question paper should be drawn in Gujarati with the English version. Students are permitted to write answer in English or Gujarati language.

Its objective are as under:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To help the colleges to update and modernize their laboratories.
3. To redesign the courses the special emphasis on local requirements, environment, to link the courses with requirements of the industries and research
4. To prepare for National level entrance test like NET/SLET/JRF and other competitive exams.

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FACULTY OF SCIENCE

CHEMISTRY SYLLABUS

(Effective from June-2022)

Common Formula For Question Paper (Core course)

Time: 3 Hours

Total Marks:70

Theory Examination Pattern(Core Course):

Que.No:1	A: Write any Two out of Three Questions	12 Marks
	B: Write any One out of Two Questions	05 Marks
Que.No:2	A: Write any Two out of Three Questions	12 Marks
	B: Write any One out of Two Questions	06 Marks
Que.No:3	A: Write any Two out of Three Questions	12 Marks
	B: Write any One out of Two Questions	05 Marks
Que.No:4	Write any Three Questions out of Five Questions. (Ask Questions from Unit-1,2 and 3 With Equal Sharing.)	18 Marks

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V

Inorganic Chemistry

Paper : CC CH-501

UNIT -I: Reaction Mechanism of Coordination Compounds

- Substitution reaction of square planar complexes
- Reaction of Platinum II complexes, the trans effect, theories of trans effect, use of synthesis in trans effect and analysis
- Substitution reaction in octahedral complexes, Possible mechanism reactions, Ligand displacement reaction in octahedral complexes, acid hydrolysis, Base hydrolysis
- Electron transfer reaction, mechanism of redox reaction, mechanism of substitution in square planar complexes

UNIT- II : Organo Metallic Compounds

- Definition
- Types of O.M.C.
- Classification
- Nomenclature of O.M.C
- Structure and bonding in dihapto and metal olefines complexes. e.g. Ziese's salt complexes, ferrocene structure
- O.M.C. of Li and Al complexes

UNIT- III : Corrosion

- Principle of corrosion
- Types of corrosion
- (I) Wet corrosion
- (II) Dry corrosion
- (III) Galvanic corrosion
- (IV) Atmospheric corrosion
- (V) Pitting corrosion
- (VI) Inner granular corrosion
- (VII) Dezincification
- Prevention of corrosion: Inhibitors- Definition, type and use of inhibitors.

Books Suggested (Inorganic Chemistry):

1. Valence and molecular structure by Cartmell and Flower.
2. Text book of Inorganic Chemistry by Durent and Durent.
3. Inorganic Chemistry by S. Chand.
4. Advance Inorganic Chemistry Vol-II Satya Prakash (S.Chand)
5. Concise Inorganic chemistry by J.D.Lee.
6. Metallic Corrosion By M.N. Desai
7. Advance Inorganic Chemistry J.E. Huhee.

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V

Organic Chemistry

Paper : CC CH-502

UNIT-I : Stereochemistry

- Conformational analysis of mono and di substituted cyclohexanes
- Molecular asymmetry as illustrated by allenes and diphenyls
- Isomerism of oximes.
- Determination of geometrical isomerism of Aldoxime.
- Determination of geometrical isomerism of Ketoxime(Beckmann's transformation)

UNIT- II

(A) Carbohydrates

- Introduction of Disaccharides
- Structure determination of
 - (1) Sucrose
 - (2) Maltose
 - (3) Lactose

(B) Isoprenoids

- Classification
- General methods of structure determination
- Isoprene rule
- Constitution of Citral, α -Terpeneol and Camphor with their synthesis

UNIT- III : Nucleophilic substitution at saturated carbon atom

- The reaction mechanism
- Mechanism of SN^1 and SN^2 reactions
- Stereochemistry of reaction SN^1 and SN^2 reactions
- Relative reactivity in substitution
- Solvent effect variation at carbon site
- Relative leaving group activity
- Neighboring group participation
- Competitive reactions. Elimination E_1 , E_2 and E_{1cb} mechanisms

Books Suggested (Organic Chemistry):

1. Organic chemistry by Morrison & Boyd Vth Edition
2. Advance organic chemistry by R.K.Bansal.
3. Organic chemistry by I.L.Finar Vol. I & II Vth Edition
4. Organic chemistry by pine, Hendrikson, Cram and Hammond IVth edition...
5. Outline of chemical technology by Dryden IInd Edition
6. Synthetic organic chemistry by Gurdeep R Chatwal.
7. Advanced organic chemistry by Jerry March.
8. Organic reactions and their mechanisms IInd edition by P.S. Kalsi.
9. Stereo chemistry: conformation and mechanism VIth edition by P.S.Kalsi.
10. Organic chemistry of natural product Vol: I & II by Gurdeep R. Chatwal.
11. Advanced organic chemistry by Arun Bahal and B.S. Bahal.
12. Organic chemistry Vol, I, II, III by S.M.Mukherjee, S.P.Singh, R.P.Kapoor.
13. Stereo Chemistry by Nasipuri.
14. Advanced Organic Chemistry by L.D.S. Yadav & Jagdambasingh, Pragati prakashan

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V

Physical Chemistry

Paper : CC CH-503

UNIT-1: Electro Motive Force

- Introduction of Terms
 - Oxidation, Reduction, Redox, Anode, Cathode
 - Electrode, Half cell
 - Oxidation & Reduction Potential
 - Galvanic cell
 - Chemical Cell
 - Electro Chemical Series
 - Nernst Equation
- Without Transference with Transference Verification of
- Concentration cell and its EMF equation.
- Electrolyte concentration cell
Concentration cell without transference, Concentration cell with transference
- Electrode concentration cell
- Liquid-Liquid junction potential
- ❖ Application of EMF measurements Determination of
- Degree of hydrolysis of salt Solubility of sparingly soluble salt
- Stability constant of complex
- Equilibrium constant
- pH
- Ionic constant of water
- Dissociation constant of weak acid,
- Numericals

UNIT:-II: Thermodynamics

- Zeroth law of thermodynamics
- Absolute temperature scale
- Nernst heat theorem
- Third law of thermodynamics
- Determination of absolute entropy
- Experimental verification of third law
- Entropy change in chemical reactions.
- Fugacity and Activity
 - The concept of Activity & Activity Coefficient
 - Approximation method
 - Determination of Fugacity of Gas
 - Fugacity of a gas in a gaseous mixture
 - Fugacity of a Liquid Component in a Solution
 - Physical Significance of fugacity

- Concept of Fugacity and determination of Graphical Method
- Numerical

UNIT- III: The Colloidal State

- Introduction
- Types of Colloidal System
- Classification of Colloids
- Difference between True Solutions, colloidal solution and suspension.
- Preparation of Colloidal Solutions.
 - (a) Dispersion Methods.
 - (b) Condensation Methods.
- Purification of Colloidal Solutions.
 - (a) Dialysis
 - (b) Ultra-filtration.
- Properties of Colloidal solution.
 - (i) Physical
 - (ii) Colligative
 - (iii) Optical
 - (iv) Kinetics
 - (v) Electrical
 - (vi) Electro kinetics properties (Zeta potential)
- Electro phoresis
- Electro Osmosis
- Stability of Colloid (Rule of Schulze Hardy)
- Gold number
- Donan membrane equilibrium and calculation of molecular Weight
- Gels and Emulsion
- Foams, Theory of Foamstability, Antifoamers.
- Importance and applications of Colloids

Books Suggested (Physical Chemistry):

1. Advance Physical Chemistry by Gurdeepraj.
2. Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P. Rastogi and R.R. Mishra.
5. Physical chemistry by atkins.
6. Essentials of Physical Chemistry by B. S. Bahal, Arun Bahal, G.D.Tuli,
7. Physical Chemistry by P.W. Atkins, 5th edn, Oxford 1994 7th edn-2002.
8. Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988,6th edn, 1996.
10. Physical Chemistry by W.J. Moore, 4th edn, Orient Longmans 1969.

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B. Sc. Chemistry

Semester : V

Structural - Analytical Chemistry

Paper : CC CH-504

UNIT:-I: Symmetry of molecules

- Symmetry elements & symmetry operations
- Multiplications of symmetry operations
- Multiplication table for C_{2v} , C_{3v} , C_{2h} point groups only
- Classification of Schoenflies point groups
- Determination of Schoenflies point group notations
- Symmetry & optical activity
- Symmetry property of orbitals for C_{2v} , C_{3v} , C_{2h} point groups

UNIT- II : NMR spectroscopy

- Introduction
- Proton magnetic resonance (1H NMR) spectroscopy
- Equivalent and non equivalent protons
- Enantiotopic and Diastereotopic Protons
- Nuclear shielding & de-shielding
- Chemical shift & molecular structure
- Intensity of Signals
- Spin-spin splitting and coupling constant
- Simplification of Complex spectra
 - Double Resonance
 - Deuterium labeling
- NMR Based Examples by Using Spectral Data

UNIT:- III : Acid-Base titration

- Construction of titration curves (Neutralization of weak acid by strong base and weak base by strong acid only)
- Neutralization of polyprotic acid (Dibasic and tribasic acid only) by strong base
- Analysis of Soda Ash
- Titration of Boric acid
- Indicators, Mechanism of Indicators
- Gran's plot
- Buffer Solution, buffer level, buffer range & buffer capacity
- Numericals

Suggested books: (structural chemistry)

1. Chemical application of group theory by F.A.Cotton
2. Chemical bonding and introduction by K.C.Patel, R.D.Patel and Raval
3. Application of group theory to chemistry by Bhattacharya
4. Symmetry in chemistry by Jafle and Orchin 9 4–2013
5. Advance inorganic chemistry by cotton & Wilkinson
6. Basic principles of spectroscopy by R.Chand
7. Organic chemistry Vol. 1 by S.M.Mukherji, S.P.Shingh, Kapoor
8. Spectroscopy organic compounds VIth edition by P.S.kalsi
9. Organic chemistry by Morrison and Boyd
10. Spectrometric identification of organic compounds IVth edition by Silverstain, Bassler and Morrill.
11. Application of absorption spectroscopy of organic compounds by John R. Dyer
12. Spectroscopic method in organic chemistry Vth edition by Dudley H. Williams & Ian Fleming
13. Physical methods for chemist Ruwssell S. Drago
14. Organic spectroscopy by Williams & Kemp
15. Organic spectroscopy by V.R.Dani
16. Qualitative Analysis R.A.Day & A.L.Underwood
17. Analytical Chemistry G.D. Christain
18. Fundamentals of Analytical Chemistry D.A.Skoog, D.M. West & F.J.Holler
19. Principales of Analytical Chemistry J.H. Kennedy
20. Analytical Chemistry – Principals & Techniques L.G.Hargis

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B. Sc. Chemistry

Semester : V

Synthetic Dyes

Paper : SE CH-505 A

UNIT :-1:

- Introduction
- Synthetic Dyes
- Chromophores, Chromogens, Oxochroms, Bathochromic shift, Hypsochromic shift
- Difference between Dyes and Pigments
- Classification of Dyes
 - According to constitution
 - According to method of coloring the fibres
- Optical Brighteners

UNIT :- II : Synthesis and uses

- Congo Red
- Eosin
- Alizarin
- Crystal violet
- Indigo
- Sefronine -T
- Methylene Blue
- Ereochrom Black -T
- Rhodamine
- Rosanilin

References Books :

1. Synthetic Dyes by Venkatramanan
2. Synthetic Dyes by G.R.Chatwal
3. Synthetic Dyes and Drugs by O.P.Agrawal
4. Synthetic Dyes by O. D. Tyagi & M. Yadav
5. Sanshlesit Rangako, Granth Nirman Board

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B. Sc. Chemistry

Semester : V

Spectrophotometry

Paper : SE CH-505 B

Unit-I: - Spectrophotometry

- Introduction, Theory of spectrophotometry and colorimeter. Lambert-Beer's law, Application of Lambert-Beer's Law, Introduction to Colorimetry ,Instrumentation of colorimeter.
- Spectrophotometry: Wavelength selection by prism and diffraction grating, Radiation source, cells, data presentation, single-beam spectrophotometer, Double-beam spectrophotometers, Numericals

Unit-II: - Atomic Spectroscopy

- Introduction, Principle, Flame Emission Spectroscopy (FES) and Atomic adsorption Spectroscopy (AAS), Principal, comparison and applications, Burners (Total consumption burner and Premix burners).

Reference Books

1. Analytical Chemistry by G. D. Christian, et al , Wiley, 6th Ed.
2. Principles of Instrumental Analysis: Holler, Skoog, Crouch 6th Ed. Thomson Publication
3. Modern Analytical Chemistry, David Harvey, Mc-Graw Hill Higher education

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B. Sc. Chemistry

Semester : V

Laboratory Course

LC CH-507

(Inorganic, Organic, Physical Chemistry)

This syllabus is to be completed by assigning four laboratory session per week, each of Three periods. The number of students in the laboratory batch should not exceed fifteen (15) the medium of instruction will be English in laboratory course

Inorganic Chemistry practical

(A) Alloy

- 1) Brass alloy ----- Zn (Gravimetric) and Cu (Volumetric)
- 2) German silver alloy -----Ni (Gravimetric) and Cu (Volumetric)
- 3) Bronze alloy -----Sn (Gravimetric) and Cu (Volumetric)

(B) Synthesis by Convention Method

- 1) Ferrous sulphate or Green vitriol ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$)
- 2) Sodium cobaltinitrate $\text{Na}_3 [\text{Co}(\text{NO}_2)_6]$
- 3) Tetra amine cupric sulphate
- 4) Hexa thio urea plumbous nitrate
- 5) Cuprous chloride

Organic Chemistry practical

(A) Qualitative Analysis (Minimum 08)

Analysis of an organic mixture containing two components using water, NaHCO_3 , NaOH , HCl as a solvent for Separation /or using distillation process for separation and identification with the suitable chemical tests and preparation of suitable derivatives.

Soluble Components:- Oxalic Acid, Succinic Acid, Resorcinol, Urea, Thiourea
(Give water soluble compounds only in solid + solid mixture and water soluble components should not given with same natured compound's mixture)

Separation of two components from Organic Mixture Such as....

Solid-Solid -----Mixture

Solid- Liquid -----Mixture

Liquid-Liquid ----- Mixture

[Liquid component must be neutral in nature]

Physical Chemistry practical

[A] Instruments: (Minimum 05)

1. To Determine the Normality and Amount of each acid in given mixture of XN (HCl+CH₃COOH) by PH metric titration using 0.1 N NaOH.
2. To Determine the Normality and Amount of each acid in given mixture of XN (HCl+CH₃COOH) by Potentiometry titration using 0.1 N NaOH.
3. To Determine the Normality and Amount of each acid in given mixture of XN (HCl+CH₃COOH) by Conductometry titration using 0.1 N NaOH.
4. To Determine the Solubility & Solubility product of Sparingly Soluble salt PbSO₄/BaSO₄ by Conductometry.
5. Determine the Concentration of Mn⁺² ions and Cr⁺³ ions in a given mixture of (K₂Cr₂O₇ + KMnO₄).
6. To Determine the Amount of Nickel in the given unknown solution by Colorimetric method.

[B] Chemical Kinetics & Adsorption:

7. To determine the order of reaction between K₂S₂O₈ and KI.
8. To determine the order of reaction between H₂O₂ and HI.
9. To study the adsorption of Acetic acid/Oxalic acid on animal charcoal and prove the validity of Freundlich Equation.

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B. Sc. Chemistry

Semester : V

Pattern of University Practical Exam

Time: 11:00am to 5:30pm (Including 30 minutes recess)

Total Marks: 200

First Day

(A) Inorganic (50 marks)

-Estimation from Alloy (30 marks) and Inorganic Preparation (20 marks)

(B) Organic (50 marks)

- Qualitative analysis of an organic mixture.

Second Day

(C) Physical (50 marks)

- Any one exercise should be selected for each candidate from syllabus.

(D) Viva-Voce and Journal

• **Viva-Voce on practical base (40 marks)**

Inorganic 13 marks

Organic 13 marks

Physical 14 marks

• **Journal (10 marks)**

➤ **Note: Certified practical journal is compulsory for practical exam.**

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B. Sc. Chemistry

Semester : V

Suggested batch distribution for practical exam

First Day:

11:00am to 2:00pm	2:30pm to 5:30pm
Inorganic: A	Inorganic: B
Organic: B	Organic: C
Physical: C	Physical: A

Second Day :

11:00am to 2:00pm	2:30pm to 5:30pm
Inorganic: C	Inorganic viva- All students (A,B & C batch)
Organic: A	Organic viva- All students (A,B & C batch)
Physical: B	Physical viva- All students (A,B & C batch)

Batch distribution (for maximum 30 students and 3 Examiners)

[Maximum 10 Students per each Examiner]

Best wishes

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : VI

Inorganic Chemistry

Paper : CC CH-601

UNIT :-1: Valency

- Variation method, Secular Equation, Stability of H_2^+ ion; M.O. approach, Stability of H_2 molecule; V. B. approach, Classical interaction energy
- Representation of wave function for SP , SP^2 and SP^3 hybrid orbitals, bond angle and bond strength
- M.O. treatment of OH molecules
- Quantum mechanical representation of Pauli's exclusion principle

UNIT :- II : Metal Carbonyl

- Introduction
- Classification: Mononuclear and Polynuclear
- Physical and Chemical Properties
- Metal Carbonyl (M-CO) bonding (On the basis of V.B.T. and M.O.T.)
- Use of IR Spectra to determination of structure of metal carbonyl
- Structure of Metal Carbonyl
 $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Fe_2(CO)_9$, $Co_2(CO)_8$, $Mn_2(CO)_{10}$, $Fe_3(CO)_{12}$
- Calculation of EAN of metal atom in metal carbonyl
- Metal Nitrosyl complexes: - Bonding in metal nitrosyl
- Classification of metal Nitrosyl

UNIT :- III : Bio-Inorganic Chemistry

- Introduction,
- Essential elements,
- Trace elements
- Metal porphyrine,
- Study of hemoglobin and myoglobin
- Nitrogen fixation: In Vivo and In Vitro

Books Suggested (Inorganic Chemistry)

1. Valence and molecular structure by Cartmell and Flower.
2. Text book of Inorganic Chemistry by Duren and Duren.
3. Inorganic Chemistry by S. Chand.
4. Advance Inorganic Chemistry Vol-II Satya Prakash (S.Chand)
5. Concise Inorganic chemistry by J.D.Lee.
6. Metallic Corrosion By M.N. Desai
7. Advance Inorganic Chemistry J.E. Huhee

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B. Sc. Chemistry

Semester : VI

Organic Chemistry

Paper : CC CH-602

UNIT :-1: Electrophilic and Free radical addition reactions

- Addition to carbon carbon double bond
- Mechanism for addition of halogens
- Reactivity order of Alkene on electrophilic addition reactions
- Stereo selective and stereo specific reaction of alkene
- Markovnikov's rule
- Addition reaction of H₂O and H₂SO₄ in alkene
- Rearrangement, Dimerization and Alkylation in electrophilic addition reactions
- Peroxide effect (Anti markovnikov's rule)
- Free radical addition, mechanism of peroxide initiated addition of HBr
- Syn and Anti addition reactions
- Electrophilic addition to conjugated dienes (1:2 v/s 1: 4 addition)
- Free radical addition to conjugated dienes

UNIT :-II : Active Methylene Group Compounds

- Introduction of Tautomerism
- Determination of keto-enol tautomerism
- Differences between Tautomerism and resonance
- Synthesis and application of Ethyl aceto acetate and malonic ester

UNIT :- III : Nucleophilic Aromatic Substitutions

- Nucleophilic aromatic substitution [Bimolecular displacement (SN²) mechanism]
- Elimination - Addition mechanism via benzyne
- Stability and properties of benzyne
- Evidences of Benzyne intermediate

Books Suggested (Organic Chemistry):

1. Organic chemistry by Morrison & Boyd Vth Edition
2. Advance organic chemistry by R.K.Bansal.
3. Organic chemistry by I.L.Finar Voll &. II Vth Edition.
4. Organic chemistry by pine, Hendrikson, Cram and Hammond IVth edition...
5. Outline of chemical technology by Dryden IInd Edition
6. Synthetic organic chemistry by Gurdeep R Chatwal.

7. Advanced organic chemistry by Jerry March.
8. Organic reactions and their mechanisms IInd edition by P.S. Kalsi.
9. Organic chemistry of natural product Vol: I & II by Gurdeep R. Chatwal.
10. Advanced organic chemistry by Arun Bahal and B.S. Bahal.
11. Organic chemistry Vol, I, II, III by S.M.Mukherjee , S.P.Singh , R.P.Kapoor.
12. Advanced Organic Chemistry by L.D.S. Yadav & Jagdambasingh, Pragati prakashan

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B. Sc. Chemistry

Semester : VI

Physical Chemistry

Paper : CC CH-603

UNIT- I : Statistical Thermodynamics

- Introduction
- Combination and permutation
- Probability
- Sterling approximate formula (No Derivation)
- Langrage's undetermined Constant
- Type of Statistics
 - Maxwell-Boltzmann
 - Bose-Einstine Statistics
 - Fermi-Dirac Statistics
- Partition Function
 - Transnational Partition function
 - Rotational Partition function
 - Vibrantional Partition function
- Numericals

UNIT :- II : Photochemistry

- Introduction
- Difference between Thermal and Photochemical reaction
- The Law of Absorption, Lambert-Beer law
- Laws of Photochemistry,
 - (1) Grotthuss-Draper law (2) Stark- Einstein law and it's deviation
- Quantum Efficiency or Quantum Yield
- Experimental determination of Quantum yield
- Reason of high and low Quantum yield
- The Jablonski diagram
- Types of Photochemical reaction
 - (1) Photosensitized reaction (2) Photochemical equilibrium
- Qualitative description of fluorescence, phosphorescence and chemiluminescence.
- Flash Photolysis
- Numerical

UNIT :- III : Chemical Kinetics

- Effect of temperature on rate of reaction (Arrhenius equation)
- Concept of Activation energy
- Theories of reaction rate
 - (1) Collision theory
 - (2) Transition state theory

- Comparison of collision and transition state theory
- Theories of Unimolecular reaction
- Lindemann's theory
- Trimolecular reaction
- Trautz's Law
- Primary salt effect
- Secondary salt effect
- Numerical

Books Suggested (Physical Chemistry) :

1. Advance Physical Chemistry by Gurdeep Raj.
2. Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P. Rastogi and R.R. Mishra.
5. Physical chemistry by atkins.
6. Essentials of Physical Chemistry by B. S. Bahal, Arun Bahal, G.D.Tuli,
7. Physical Chemistry by P.W. Atkins, 5th edn, Oxford 1994 7th edn-2002.
8. Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988,6th edn,1996.
10. Physical Chemistry by W.J.Moore, 4th edn, Orient Longmans 1969

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B. Sc. Chemistry

Semester : VI

Structural - Analytical Chemistry

Paper : CC CH-604

UNIT :-1: Term symbol & spectra of d'-do Octahedral complexes

(A) Term Symbol

- LS coupling
- JJ coupling
- Determination of ground state term by hund's rules
- Determination of term symbol for all state for p^2 & d^2 configuration by pigeon hole diagram

(B) Spectra of d^1 & d^9 octahedral complexes

- Selection rules & intensities transitions
- Oral diagram for d^1-d^9 , d^2-d^8 , d^3-d^7 , d^4-d^6 octahedral & tetrahedral complexes explanation of d^1 & d^9 spectra(only introduction-no application)

UNIT :-11: IR spectra & Numericals based on UV, IR and NMR Spectra

(A) Infrared spectroscopy.

- Introduction
- Molecular vibrations (Fundamental vibrations of AX_2 type molecules)
- Characteristics of IR spectroscopy
- Sample techniques • Fingerprint region
- Effect of IR in geometrical isomerism
- IR spectra & H-bonding • Factor affecting on $>C=O$ group frequencies
- Differentiate two compounds by the IR frequencies.

(B) Problems pertaining to the structure elucidation of organic compounds using UV, IR & NMR spectroscopic Data

UNIT :- III: Chromatography

- Introduction
- Classification of chromatographic techniques
- Column chromatography
- Paper chromatography
- Thin layer chromatography
- Ion exchange chromatography
- Gas chromatography : Principle, Plate theory and Rate theory (only introduction)
- Application of chromatographic Techniques

Suggested books: (structural chemistry)

1. Chemical application of group theory by F.A.Cotton
2. Chemical bonding and introduction by K.C.Patel, R.D.Patel and Raval
3. Application of group theory to chemistry by Bhattacharya
4. Symmetry in chemistry by Jafle and Orchin
5. Advance inorganic chemistry by cotton & Wilkinson
6. Basic principles of spectroscopy by R.Chand
7. Organic chemistry Vol. 1 by S.M.Mukherji, S.P.Shingh, Kapoor
8. Spectroscopy organic compounds VIth edition by P.S.kalsi
9. Organic chemistry by Morrison and Boyd
10. Spectrometric identification of organic compounds IVth edition by Silverstain, Bassler and Morrill.
11. Application of absorption spectroscopy of organic compounds by John R. Dyer
12. Spectroscopic method in organic chemistry Vth edition by Dudley H. Williams & Ian Fleming
13. Physical methods for chemist Ruwssell S. Drago
14. Organic spectroscopy by Williams & Kemp
15. Organic spectroscopy by V.R.Dani
16. Qualitative Analysis R.A.Day & A.L.Underwood
17. Analytical Chemistry G.D. Christain
18. Fundamentals of Analytical Chemistry D.A.Skoog, D.M. West & F.J.Holler
19. Principales of Analytical Chemistry J.H. Kennedy
20. Analytical Chemistry – Principals & Techniques L.G.Hargis

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B. Sc. Chemistry

Semester : VI

Polymer Chemistry

Paper : SE CH-605 A

UNIT:-1: Polymers – 1

- Introduction
- Classification and Nomenclature of polymers
- Isomerism of polymers
- Chain growth polymerization - Introduction
- Mechanism of free-radical, Cationic and Anionic polymerization
- Kinetics of free radical, Cationic and Anionic polymerization
- Mechanism and Kinetics polycondensation

UNIT:- II : Polymers - 2

- Polymerization Techniques
- Concept of Averages
 - Number average molecular weight
 - Weight average molecular weight
 - Viscosity average molecular weight
- Molecular weight and Degree of polymerization
- Poly dispersity and molecular weight distribution
- Methods for determination of molecular weight
- Membrane Osmometry, Viscometry and Light Scattering

Reference Books:

1. Principles of polymers Science by P.Bahadur and N.V.Sastry.(Second Edition)
2. Polymer Science by V.R. Gowariker, N.V.Vashwanathan and Jaydev Shreedhar.

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B. Sc. Chemistry

Semester : VI

Electro Analytical Techniques

Paper : SE CH-605 B

Unit-1

- **Potentiometry**- The scope of potentiometric titrations, Precipitation and neutralization titrations, Graphical method including Gran's plot for selecting end point, Differential titration, Dead stop titration, Ion selective Electrode, various types of Ion selective Electrodes and applications of Ion selective electrodes,
- **pHmetry**- Introduction, types of indicator electrodes and reference electrodes
- **Conductimetry**- Introduction, types of conductance, effect of dilution, conductivity cells, types of titration.

Unit-2

- **Polarography**: Introduction, Principle, electrode, Types of currents, Determination of half wave potential, Ilkovic equation, methods of determining concentration (Standard addition method and Calibration method), Applications of Polarography.

Reference Books:

- (1) Analytical Chemistry: Gary D. Christian, 6th Edition; Wiley & Sons
- (2) Fundamentals of Analytical Chemistry: D. A. Skoog, D. M. West and F. J. Holler, 9th Edition, Cengage Learning.
- (3) Instrumental Methods of analysis: (CBS) H.H . Willard, L.L. Mirrit, J.A. Dean
- (4) Instrumental Methods of Inorganic Analysis: A.I. Vogel, ELBS
- (5) The principals of ion-selective electrodes and membrane transport: W.E.Morf
Principles of Instrumental Analysis: Douglas A. Skoog., F. James Holler, Stanley R. Crouch, Cengage Learning; 6th Edition.

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B. Sc. Chemistry

Semester : VI

Laboratory Course

LC CH-607

(Inorganic, Organic, Physical Chemistry)

Inorganic Chemistry practical

Qualitative analysis (Minimum 10)

Inorganic mixture should be comprised of six radicals.

Candidate if required should be guided once for the wrong group and marks deducted for wrong group. Maximum of five marks can be deducted for wrong group. There shall be no deduction of marks for reporting wrong radicals

Organic Chemistry practical

(A) Estimation of functional groups:

- (1) Estimation of Amide
- (2) Estimation of Ascorbic acid
- (3) Estimation of Aspirin

(B) Synthesis of Organic Compounds

- (1) Preparation of m-Dinitro benzene from Nitrobenzene
- (2) Preparation of p-Nitro acetanilide from Acetanilide
- (3) Preparation of Acetanilide from Aniline
- (4) Preparation of Aspirine from Salicylic acid
- (5) Preparation of Di-benzal acetone from Benzaldehyde

Physical Chemistry

[Instruments): (Minimum 05)

- (1) To Determine the Normality and Amount of each Base in given mixture of XN (NaOH +NH₄OH) by pH metric Titration using 0.1 N HCl.
- (2) To Determine the normality and amount of KI in given solution of XN KI by Potentiometry titration using 0.1 N KMnO₄.
- (3) To Determine the formal Redox potential of Fe⁺²/Fe⁺³ system by Potentiometry titration.
- (4) To Determine the Normality and Amount of each Base in given mixture of XN (NaOH+NH₄OH) by Conductometry Titration using 0.1 N HCl..
- (5) Determine the concentration of Cu⁺² ions and CO⁺² ions in in a given mixture of (CuSO₄ 5H₂O + COCl₂ 6H₂O).
- (6) To Determine the amount of Nitrite in the given unknown Solution by Colorimetric method.

[B] Kinetics, Adsorption & Polymer (Minimum 03)

- (7) To Study the Influence of Ionic Strength on Rate of Reaction between K₂S₂O₈ and KI.
- (8) To Study the reaction between KBrO₃ and KI at two different Temperature and Calculate the Temperature Coefficient and Energy of Activation.
- (9) To Study the Distribution of Benzoic Acid between Benzene and water at Room Temperature and Prove the Dimerization of Benzoic acid in Benzene.

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : VI

Pattern of University Practical Exam

**Time: 11:00am to 5:30pm (Including 30 minutes recess)
200**

Total Marks:

First Day

(A) Inorganic (50 marks)

- Inorganic Qualitative Mixture

(B) Organic (50 marks)

- Estimation (25 Marks) & Preparation (25 Marks)

Second Day

(C) Physical (50 marks)

- Any one exercise should be selected for each candidate from syllabus.

(D) Viva-Voce and Journal

• **Viva-Voce on practical base (40 marks)**

- Inorganic 13 marks

- Organic 13 marks

- Physical 14 marks

• **Journal (10 marks)**

➤ **Note: Without Certified practical record a student will not be permitted to appear at practical examination.**

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : VI

Suggested batch distribution for practical exam

First Day:

11:00am to 2:00pm	2:30pm to 5:30pm
Inorganic: A	Inorganic: B
Organic: B	Organic: C
Physical: C	Physical: A

Second Day :

11:00am to 2:00pm	2:30pm to 5:30pm
Inorganic: C	Inorganic viva- All students (A,B & C batch)
Organic: A	Organic viva- All students (A,B & C batch)
Physical: B	Physical viva- All students (A,B & C batch)

Batch distribution (for 30 students and 3 Examiners)

[Maximu 10 Students per each Examiner]

Best wishes