HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Programme code :		**Programme Name :**	B.Sc.
Faculty :	SCIENCE	**Semesters :**	V
Subject :	CHEMISTRY		
Effective from :	HGvZ_!# YL		

Sr.	Paper Code	Name of Paper	Credit
1	CC CH- 501	CORE COMPULSORY-INORGANIC CHEMISTRY - I	3
2	CC CH-502	CORE COMPULSORY-ORGANIC CHEMISTRY - II	3
3	CC CH- 503	CORE COMPULSORY-PHYSICAL CHEMISTRY - III	3
4	CC CH- 504	CORE COMPULSORY-STRUCTURAL-ANALYTICAL CHEMISTRY - IV	3
5	SE CH- 505 A	Synthetic Dyes	2
	SE CH- 505 B	Oils, Fats and Waxes	
	SE CH- 505 C	Paints and Varnishes	
	SE CH- 505 D	Cosmetic Chemistry	
	SE CH- 505 E	Metallurgy	
6	GE CH- 506 A	ELECTIVE (GENERIC) COURSE	2
	GE CH- 506 B	ELECTIVE (GENERIC) COURSE	
	GE CH- 506 C	ELECTIVE (GENERIC) COURSE	
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

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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Programme code :		**Programme Name :**	B.Sc.
Faculty :	SCIENCE	**Semesters :**	VI
Subject :	CHEMISTRY		
Effective from :	HGvZ_!# Yl		

Sr.	Paper Code	Name of Paper	Credit
1	CC CH- 601	CORE COMPULSORY-INORGANIC CHEMISTRY - I	3
2	CC CH-602	CORE COMPULSORY-ORGANIC CHEMISTRY - II	3
3	CC CH- 603	CORE COMPULSORY-PHYSICAL CHEMISTRY - III	3
4	CC CH- 604	CORE COMPULSORY-STRUCTURAL-ANALYTICAL CHEMISTRY - IV	3
5	SE CH- 605 A	Polymer Chemistry	2
	SE CH- 605 B	Chemistry of Portland Cement	
	SE CH- 605 C	Food Additives	
	SE CH- 605 D	Soaps and Detergents	
	SE CH- 605 E	Forensic Chemistry & Toxicology	
6	GE CH- 606 A	ELECTIVE (GENERIC) COURSE	2
	GE CH- 606 B	ELECTIVE (GENERIC) COURSE	
	GE CH- 606 C	ELECTIVE (GENERIC) COURSE	
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

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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

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

N. Gujarat. INDIA.

NAAC Accreditation Grade – "B"

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www.ngu_patan.org

FACULTY OF SCIENCE

CHEMISTRY SYLLABUS

(Effective from June-2013)

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-2013)

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	**14 Marks**
	B: Write any One out of Two Questions	**06 Marks**
Que. No : 2	A: Write any Two out of Three Questions	**14 Marks**
	B: Write any One out of Two Questions	**06 Marks**
Que. No : 3	A: Write any Two out of Three Questions	**14 Marks**
	B: Write any One out of Two Questions	**06 Marks**
Que. No : 4	Write any Ten out of Twelve Short question / M.C.Q / Short numerical / diagram (Four Questions to be asked from each Unit.)	**10 Marks**

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

PATAN-384265

NAAC Accreditation Grade – "B"

FACULTY OF SCIENCE

Chemistry syllabus

Effective from June-2013

This syllabus is to be completed by assigning three periods of one hour each and four practicals of three hours each per week. The number of students in a practical batch should not exceed fifteen.

Pattern of examination:

There will be four paper for core compulsory and one paper for subject elective theory and fourteen hours (two days) for practical in the university examination

The pattern of university exam :

Written	Examination time	Marks External	Marks Internal
Core Course	3 hours (per course)	70	30
Practical Core Course	7 hours (two days)	200	--
Subject elective course	2 hours	50	--

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V HGvZ_!#YL

Inorganic Chemistry

Paper : CC CH – 501

UNIT – I : Reaction Mechanism of Coordination Compounds

- Substitution reaction of square plannar 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 plannar 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 olifines complexes. e.g. Ziese's salt complexes, ferrocine structure
- O.M.C. of Li and Al complexes

UNIT- III : Corrosion

- Principle of corrosion
- Types of corrosion
- (i) Wet corrosion
- (II) Galvanic corrosion
- (III) Atmospheric corrosion
- (IV) Pitting corrosion
- (V) Inner granual corrosion
- (VI) Dezincfication
- Prevention of corrosion: Inhibitors- Definition, type and use of inhibitors.

Books Suggested (Inorganic Chemistry):

1. Valance and molecular structure by Cartmell and Flower.
2. Text book of Inorganic Chemistry by Durent and Durent.

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3. Inorganic Chemistry by S. Chand. HGvZ_ !# Yl

4. Advance Inorganic Chemistry Vol-II Satya Prakash (S.Chand)

5. Concise Inorganic chemistry by J.D.Lee.

6. Metalic Corrosion By M.N. Desai

7. Advance Inorganic Chemistry J.E. Huhee.

Hemchandracharya North Gujarat University, Patan

B.Sc Chemistry

Semester : V HGvZ_!# YL

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

(B) Isoprenoids

- Classification
- General methods of structure determination
- Isoprene rule
- Contitution of Citral and α-Terpeneol and their synthesis

UNIT- III : Nucleophilic substitution at saturated carbon atom

- The reaction mechanism
- Stereochemistry of nucleophilic substitution
- Scope of nucleophilic substitution
- Stereochemistry of SN^1 and SN^2 reaction
- 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): HGvZ_!#Yl

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.

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V HGvZ_!#YL

Physical Chemistry

Paper : CC CH – 503

UNIT- I : Electro Motive Force

- Chemical Cell: Without Transference with Transference Verification of Concentration cell and it's EMF equation.
- Electrolyte concentration cell
  Concentration cell without transference, Concentration cell with transference
- Electrode concentration cell
- Amalgam concentration cell, Gas 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,
- Dissociation constant of weak acid,
- Numericals

UNIT- II : Statistical Thermodynamics

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

UNIT- III : Macromelecules

- Classification of Polymers HGvZ_!#Yl
- Tacticity of polymers. (Optical Isomers)
- Polymerization reaction with example
  - Addition Polymerization. (Polyethylene, Polystyrene,PVC)
  - Condensation Polymerization (Nylon-66, Dacron)
- Mechanisms of Polymerization
  - Free radical chain Polymerization
  - Anionic Polymerization
  - Cationic Polymerization
- Kinetics of Free radical chain Polymerization
- Degree of Polymerization
- Molar masses of Polymer
  - Number Average Molar Mass
  - Weight Average Molar Mass
- Determination of Molar Masses of Macro Molecules
  - Viscosity Method
  - Light Scattering Method
  - Numerical

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, 5^{th} edn, Oxford 1994 7^{th} edn-2002.
8. Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5^{th} edn, Mac Graw Hill, 1988,6^{th} edn, 1996.
10. Physical Chemistry by W.J.Moore, 4^{th} edn, Orient Longmans 1969.

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B. Sc. Chemistry

Semester : V HGvZ_!# YL

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 schoonflies point groups
- Determination of schoonflies point groups natations
- Symmetry & optical activity
- Symmetry property of orbital's 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
- Nuclear shielding & de-sheilding
- Chemical shift & molecular structure
- Spin-spin splitting and coupling constant
- Area of signals
- Interpretations of PMR spectra
  Simple organic molecule such as ;
  (1) Ethyl bromide (2) Ethanol (3) Acetaldehyde (4) 1,1,2-Try bromo ethane (5) Ethyl acetate (6) Toluene (7) Acetophenone (8) Iso propyle Benzene (9) Acetic acid (10) Phenitol

UNIT:- III : Acid- base titration

- Construction of titration curves
- Feasibility of titration of poly protic acid
- Analysis of mixture of acid & base
- Differential titration of alkalis
- Gran's plot
- Buffers , buffer level , buffer range & buffer capacity

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

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4. Symmetry in chemistry by Jafle and Orchin HGvZ_!# Yl
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 HGvZ_!#YL

Synthetic Dyes

Paper : SE CH – 505 A

UNIT :- I :

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

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 HGvZ_!#YL

Oils, Fats and Waxes

Paper : SE CH – 505 B

UNIT:- I : Oils, Fats, and Waxes

- Introduction
- Distinction between oils and fats properties
- Classification
- Vegetable oils
- Manufacture of cotton seed oil by expression and solvent extraction
- Manufacture of soybean oil by solvent extraction
- Refining of crude vegetable oils
- Some other vegetable oils
- Animal oils, animal fats and oils
- Processing of animal fats and oils
- Mineral oils
- Difference between animal, vegetable and mineral oils
- Essential oils
- Isolation and uses of essential oils
- Waxes
- Classification of waxes
- Properties of waxes
- Some common waxes
- Qualitative solubility of waxes

UNIT:- II : Analysis of Oils, Fats and Waxes

- Saponification value
- Ester value
- Acid value
- Iodine value-wijs methods
- Richert meissl value

- Henher value HGvZ_!# YL
- Elaiden test
- Aniline point
- Hydrogenation of oils
- Optimum conditions for the Hydrogenation process
- The dry process
- The wet process
- Manufacture of candles

Reference Books :

1. Industrial Chemistry By B. K. Sharma
2. Dryden's Outlines of Chemical Technology, 3rd Edition , East-West Press

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

- **Semester : V** HGvZ_!#Yl

Paints and Varnishes

Paper : SE CH – 505 C

UNIT:- I : Paints

- Historical background of Paint : Natural and synthetic
- Main Components of Paints
  - Pigments
  - Vehicle or medium
  - Thinners
  - Driers
  - Fillers
  - Plasticizers
- Different Color changing paint
- Art and use of Paint : Methods of Application of Paints
- Various Application of Paint
- Failure of a paint: Chalking, Fracking, Cracking, Blistering, Change of colour
- Prevention of failure of Paint FILM
- Synthesis of oil soluble dyes: Red, orange, blue
- Emulsion Paints; Cement Paints; Distempers

UNIT:- II : Varnishes

- History
- Components of classic varnish:-: Drying oil; Resin, Turpentine or solvent.
- Characteristics of good varnishes
- Types of Varnish
  - Violin
  - Resin
  - Shellac
  - Alkyd

- Spar varnish HGvZ_!# Yl
- Drying Oils
- Polyurethane
- Enamles
- Lacquer
- Acrylic

- Differentiate between paint and varnish

References Books :

1. Industrial Chemistry by B.K.Sharma

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B. Sc. Chemistry

Semester : V H|GvZ_ !# YL

Cosmetic Chemistry

Paper : SE CH – 505 D

UNIT:- I : Introduction to Cosmetics

- What are cosmetics?
- Analysis of cosmetics (Name the methods only)
  - Separation of the components
  - Identification of the ingredients
  - Quantitative determination of these ingredients
- Types of the cosmetics-Definition, Compositions and uses
  - Lipsticks
  - Nail enamels
  - Shampoos and soaps
  - Deodorants and antiperspirants
  - Hair sprays
  - Sunscreens
  - Cream, Lotions and Talcum powder
  - Hair dyes
- Name of the leading producers in cosmetics

UNIT:- II : Cosmetics and health

- pH of the cosmetic products
- Preservatives - botanical, parabens and formaldehyde releasing
- Toxic chemicals used as a ingredients
  - Antibacterials (triclosan)
  - Butylacetate
  - Butylated hydroxyl toluene
  - Coaltar
  - Diethanolamine
  - 1,4-dioxane
  - Formaldehyde
- Indian standards for the various cosmetic products

Reference Books: HGvZ_!# YL

1. Herbal cosmeticshandbook by H panda, Asia pacific business press publications
2. Org. chem. for cosmetic chemists by Anthony and Thomas, Allured publishing house
3. Beginning cosmetic chemistry by Randy scheuller and Pery romanoswaki, Allured publishing house
4. Encyclopedia of Industrial Chemical Analysis vol-11, Wiley publishers

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V HGvZ_!#YL

Metallurgy

Paper : SE CH – 505 E

UNIT:- I :

- Introduction
- Occurrence of Metals
- Mineral wealth of India
- Ore dressing
    - Gravity Separation (Hydraulic washing)
    - Froth flotation method
    - Magnetic Separation Method
- Production of the metal
    - Calcination
    - Roasting
    - Smelting and Reduction of the metal oxide

UNIT:- II :

- Purification of the Metals :
    - Electrolysis
    - Metal refining by Complexation
    - Van Artel
    - deboer method
    - Bassemerisation
    - Zone Refining
- Microbial Metallurgy
- Advantages of Microbial Metallurgy
- Extraction,Separation and Purification of Al and Ge from its Ore

References Books :

1. Inorganic Chemistry by R. Gopalan pp 567-590
2. Textbook of Inorganic Chemistry, by P.L.Soni

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B. Sc. Chemistry

Semester : V HGvZ_!#YL

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 ($FeSO_4$ $7H_2O$)
2) Sodium cobaltinitrate Na_3 $[Co(No_2)_6]$
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 for Separation /or using distillation process for separation and identification with the Preparation of Suitable derivatives.

Soluble Components:- Oxalic Acid, Succinic Acid, Resorcinol, Urea, Thio Urea

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 HGvZ_!# YL

[A] Instruments: (Minimum 05)

1. To determine normality and amount of HCl and CH_3COOH in the given solution by Conductometric titration against 0.2N (exact) NaOH solution.
2. To determine the solubility product and solubility of springly soluble salts $PbSO_4$ by Conductometry.
3. To determine Normality and amount of each acid in the given mixture of HCl + CH_3COOH by pH metrically.
4. To determine the strength of strong and weak acid in a given mixture by Potentiometric titration using 0.1 N NaOH
5. To determine the concentration of Nickel in the given solution by Colourimetric estimation.
6. To determine the concentration of unknown solution from given $KMnO_4$ solution by Colourimetry.

[B] Kintetics & Distributions: (Minimum 03)

7. To determine the order of the reaction between $K_2S_2O_8$ and KI.
8. To determine the order of the reaction between H_2O_2 and HI.
9. To determine the distribution coefficient of Iodine between $CCl_4/CHCl_3$.& water at a given temperature.
10. To study the distribution of Benzoic acid between Benzene and water at room temperature and prove the dimerization of Benzoic acid in Benzene.

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B. Sc. Chemistry

Semester : V HGvZ_!#YL

Pattern of University Practical Exam

Time: 10:30am to 6:00pm (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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Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : V HGvZ_!# YL

Suggested batch distribution for practical exam

First Day:

10:30am to 2:00pm	2:30pm to 6:00pm
Inorganic: A Organic: B Physical: C	Inorganic: B Organic: C Physical: A

Second Day :

10:30am to 2:00pm	2:30pm to 6:00pm
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 24 students)

A = 1 to 8
B = 9 to 16
C = 17 to 24

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Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : VI HGvZ_!# YL

Inorganic Chemistry

Paper : CC CH – 601

UNIT :- I : 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 hybride 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. Valance 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. Metalic Corrosion By M.N. Desai
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B.Sc. Chemistry

Semester : VI HGvZ_!# YL

Organic Chemistry

Paper : CC CH - 602

UNIT :- I : Electrophillic and free radical addition reaction

- Addition to carbon carbon double bond
- Markovnikov's rule
- Electrophillic addition, Orientation, Reactivity, Rearrangement, Dimerization, Alkylation
- Peroxide effect (Anti markovnikov`s rule)
- Free radical addition, mechanism of peroxide initiated addition of HBr
- Syn and anti addition mechanism for addition of halogens
- Electrophillic addition to conjugated dienes (1: 2 v/s 1: 4 addition)
- Free radical addition to conjugated dienes, reactivity

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 : Nucleophillic Aromatic Substitutions

- Nucleophilic aromatic substitution [Bimolecular displacement (SN^2) 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 V^{th} Edition
2. Advance organic chemistry by R.K.Bansal.
3. Organic chemistry by I.L.Finar Vol I &.II V^{th} Edition

4. Organic chemistry by pine, Hendrikson, Cram and Hammond IVth edition... HGvZ_!#YL

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.

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B. Sc. Chemistry

Semester : VI HGvZ_!#YL

Physical Chemistry

Paper : CC CH – 603

UNIT:- I : 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.
- Concept of Fugacity and determination of Graphical Method
- Numerical

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 devation
- Quantum Efficiency or Quantum Yield
- Experimental determination of Quantum yield
- Reason of high and low Quantum yield
- 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 (Arhaneous equation) HGvZ_!#Yl
- 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, 5^{th} edn, Oxford 1994 7^{th} edn-2002.
8. Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5^{th} edn, Mac Graw Hill, 1988,6^{th} edn, 1996.
10. Physical Chemistry by W.J.Moore, 4^{th} edn, Orient Longmans 1969.

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B. Sc. Chemistry

Semester : VI HGvZ_!#YL

Structural – Analytical Chemistry

Paper : CC CH - 604

UNIT :- I : Term symbol & spectra of d^1-d^9 Octahedral complexes

(A)Term Symbol

- L S coupling
- J J 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 :- II : 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 zone
- 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 techniques (one out of two)

UNIT :- III : Chromatography

- Introduction
- Types of chromatography
- Column chromatography
- Paper chromatography
- Thin layer chromatography
- Ion exchange chromatography

- Van-deemter equation HGvZ_!#Yl
- examples
- HPLC principle
- Application of chromatography

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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Semester : VI HGvZ_!#YL

Polymer Chemistry

Paper : SE CH – 605 A

UNIT:- I : 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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Semester : VI HGvZ_!#YL

Chemistry of Portland Cement

Paper : SE CH – 605 B

UNIT :- I :

- Introduction
- History of Portland Cement
- Types of Portland Cement
- Other Types of Portland Cement
- Indian Standard Institute (ISI) Specification of Cement

UNIT :- II :

- Manufacturing process of Portland Cement
- Reaction in the kiln
- Mixing of Additives to cement
- Setting of Cement
- Growth of Cement Industry in India

References Books :

1. Industrial Chemistry by B.K.Sharma

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Semester : VI HGvZ_!#YL

Food Additives

Paper : SE CH – 605 C

UNIT :- I :

- Introduction
- Food Additives and functionalities
- Food additives regulations
  - GRAS
  - The Delaney closes
  - Unintentional
- Assessment of Food Additives

UNIT :- II :

- Classification of Food additives
- Mechanism and chemistry of
  - Flavoring Agents
  - Emulsifiers
  - Acidulants
  - Antioxidants
  - Thikners
  - Sweeteners
  - Food colours
  - Preservatives
  - Aroma
- Functional classes Food Additives
- List of Authorized Food Additives
- Risk benefit Ratio

Reference Books:

1. Food Chemistry by Alex V. Ramani, MJP Publications, 2009
2. CRC Handbook of Food Additives 2nd Edition, Volume No. II, 2011
3. Tanya Lousise Ditschun and Carl K. Winter 2000
4. Food and Safety and authority of Ireland Published by guidance of Food Additives 2010

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B. Sc. Chemistry

Semester : VI HGvZ_!#YL

Soaps and Detergents

Paper : SE CH – 605 D

UNIT :- I : Soaps

- Soap and its manufacture
- General consideration in soap making
- Manufacture of soap
- Toilet and transparent soap, metal soaps, other soaps
- Oil to be used for soaps
- Cleansing action of soaps
- Recovery of glycerin from spent lye

UNIT :- II : Detergents

- Introduction
- Principal groups of synthetic detergents
- Classification of surface active agents
- Anionic detergents
- Nonionic detergents
- Alkyl sulphates, alkyl aryl sulphonates, alkyl sulphonates, amide sulphonates
- Miscellaneous compounds
- Cationic detergents
- Biodegradability of surfactants
- Detergents containing enzymes
- Eco-friendly detergents
- Zeolites
- Manufacture of shampoos

Reference Books :

1. Industrial Chemistry By B. K. Sharma
2. Dryden's Outlines of Chemical Technology, 3rd Edition , East-West Press

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B. Sc. Chemistry

Semester : VI HGvZ_!#YL

Forensic Chemistry & Toxicology

Paper : SE CH – 605 E

UNIT :- I : Introduction of Forensic science, Law, Crime

- Introduction Defination, and Scope of Forensic Science
- History and development, Needs and Principles
- Police and Forensic sciences Laboratory
- Defination, Theories and Prevention of Crime
- Structure of Police, Police & Forensic Scientist
- Relationship with reference to Crime Investigation

UNIT :- II : Forensic Chemistry & Toxicology

- Introduction of Forensic chemistry
- Types of cases received for analysis
- Overview of Forensic chemical analysis
- Forensic analysis of Beverages
  - Alcoholic Beverages (Alcohol, Chloroform)
  - Non-Alcoholic Beverages
- Examination of Chemicals (Phenolphthalein) used in Bribe Trap cases
- Analysis of Adulterated Food
- Introduction of Toxicology
- Classification of Toxicology
- Extraction of Poisons
- Analysis of Poisons

Reference Books:

1. Forensic science in criminal investigation and trials, 4th edition by Dr.B.R.Sharma, Universal law Publishing co. pvt. ltd.

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B. Sc. Chemistry

Semester : VI HGvZ_!#YL

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 shell be no deduction of marks for reporting wrong radicals

Organic Chemistry practical

(A) Estimation of functional groups: (Minimum 03)

(1) Estimation of Ester

(2) Estimation of Amide

(3) Estimation of Ascorbic acid

(4) Estimation of Aspirin

(B) Synthesis of Organic Compounds (Minimum 05)

(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

(6) Preparation of 2,4,6-Tribromo aniline from Aniline

[Instruments]: (Minimum 05)

1. To determine concentration of the given Iodide solution by Potentiometric titration against 0.1N $KMnO_4$ solution.
2. To determine formal redox potential of Fe^{+2}/Fe^{+3} by Potentiometry.
3. To determine the concentration of the **nitrite** in the given solution by Colourimetric estimation method.
4. To determine the concentration of unknown solution from given $K_2Cr_2O_7$ by Colourimetry.
5. To determine the Solubility product and solubility of sparingy soluble salt of $BaSO_4$ by Conductometry.
6. To determine the strength of strong and weak base in a given mixture using a pH meter.

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

7. To study the reaction between $KBrO_3$ and KI at two different temperature and calculate the temperature coefficient and the energy of activation.
8. To study the absorption of Acetic Acid on Charcoal and prove the validity of freundlich equation.
9. To determination of molecular weight of high polymer (i.e. polystyrene) by Viscosity mesasurent.
10. To study the rate constant of the reaction between $K_2S_2O_8$ and KI and study the influence of ionic strength on the rate constant

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Pattern of University Practical Exam

Time: 10:30am to 6:00pm (Including 30 minutes recess) Total Marks: 200

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.**

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Semester : VI HGvZ_!#YL

Suggested batch distribution for practical exam

First Day:

10:30am to 2:00pm	2:30pm to 6:00pm
Inorganic: A Organic: B Physical: C	Inorganic: B Organic: C Physical: A

Second Day :

10:30am to 2:00pm	2:30pm to 6:00pm
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 24 students)

A = 1 to 8
B = 9 to 16
C = 17 to 24

Best wishes

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