SCHEME OF EXAMINATION

&

DETAILED COURSE STRUCTURE

FOR

BACHELOR OF SCIENCE (B.Sc. Hons.)

SUBJECT – CHEMISTRY

(2016-2019)

DEPARTMENT OF CHEMISTRY

S.S. JAIN SUBODH P.G. AUTONOMOUS COLLEGE

RAMBAGH CIRCLE, JAIPUR-302004
## Bachelor of Science  B.Sc. (Hons.)
### Subject – Chemistry

### Examination Scheme:

<table>
<thead>
<tr>
<th>Semester- I</th>
<th>Paper</th>
<th>Nomenclature of Paper</th>
<th>Paper Code</th>
<th>Max. Marks</th>
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</thead>
<tbody>
<tr>
<td>Paper-I</td>
<td>Inorganic Chemistry</td>
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<td>Paper-II</td>
<td>Organic Chemistry</td>
<td>BCHE(H)-102</td>
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<tr>
<td>Paper-III</td>
<td>Physical Chemistry</td>
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<th>Paper</th>
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<td>Physical Chemistry</td>
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<td>Paper-IV</td>
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<tbody>
<tr>
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<td>Physical Chemistry</td>
<td>BCHE(H)-303</td>
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<td>Paper-IV</td>
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<table>
<thead>
<tr>
<th>Semester- IV</th>
<th>Paper</th>
<th>Nomenclature of Paper</th>
<th>Paper Code</th>
<th>Max. Marks</th>
</tr>
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<td>Paper-II</td>
<td>Organic Chemistry</td>
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<td>Physical Chemistry</td>
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<td>Paper-IV</td>
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<table>
<thead>
<tr>
<th>Semester- V</th>
<th>Paper</th>
<th>Nomenclature of Paper</th>
<th>Paper Code</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
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<td>Paper-I</td>
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<td>BCHE(H)-501</td>
<td></td>
<td>75 Marks</td>
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<tr>
<td>Paper-II</td>
<td>Organic Chemistry</td>
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<tr>
<td>Paper-III</td>
<td>Physical Chemistry</td>
<td>BCHE(H)-503</td>
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<td>75 Marks</td>
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<td>Paper-IV</td>
<td>Analytical Chemistry</td>
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<td></td>
<td>Chemistry Practical</td>
<td>BCHE(H)-551</td>
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<td>150 Marks</td>
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<table>
<thead>
<tr>
<th>Semester- VI</th>
<th>Paper</th>
<th>Nomenclature of Paper</th>
<th>Paper Code</th>
<th>Max. Marks</th>
</tr>
</thead>
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<td>Paper-I</td>
<td>Inorganic Chemistry</td>
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<td>75 Marks</td>
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<td>Paper-II</td>
<td>Organic Chemistry</td>
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<td>75 Marks</td>
</tr>
<tr>
<td>Paper-III</td>
<td>Physical Chemistry</td>
<td>BCHE(H)-603</td>
<td></td>
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<td>Paper-IV</td>
<td>Analytical Chemistry</td>
<td>BCHE(H)-604</td>
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<td>75 Marks</td>
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<td></td>
<td>Chemistry Practical</td>
<td>BCHE(H)-651</td>
<td></td>
<td>150 Marks</td>
</tr>
</tbody>
</table>

**Examination Scheme for each Paper**

<table>
<thead>
<tr>
<th>Part A</th>
<th>10 QUESTIONS (very short ans ques. with any 7 out of 10)</th>
<th>7X 2 MARK EACH = 14 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part B</td>
<td>4 QUESTIONS (1 question from each unit with Internal choice)</td>
<td>4 X 10 MARK EACH = 40 Marks</td>
</tr>
<tr>
<td></td>
<td>Total of End semester exam (duration of exam 3 hours)</td>
<td>= 54 Marks</td>
</tr>
<tr>
<td></td>
<td>Internal assessment</td>
<td>= 21 Marks</td>
</tr>
<tr>
<td></td>
<td>Maximum Marks (Each theory paper)</td>
<td>= 75Marks</td>
</tr>
<tr>
<td></td>
<td>Max. Practical Marks</td>
<td>= 150 Marks</td>
</tr>
</tbody>
</table>

*Internal Marks 60+ external marks 90*

**Total of Theory Papers:** 4 X 75Marks Each = 300 Marks (Min. Pass Marks 40%)

**Total of Practical Marks**  = 150Marks

**Grand Total of Subject per Semester**  = 450 Marks
The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

### SCHEME OF EXAMINATION
(Semester Scheme)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Paper</th>
<th>ESE</th>
<th>CIA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Theory</td>
<td>70%</td>
<td>30%</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>Practical</td>
<td>60%</td>
<td>40%</td>
<td>100</td>
</tr>
</tbody>
</table>

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 7 hours duration

The number of papers and the maximum marks for each paper/ practical shall be shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory part as well as practical part of a subject separately.

Note: Maximum marks for a theory paper is 75 marks which include 54 marks for ESE and 21 marks for internal assessment.
BACHELOR OF SCIENCE (Hons.)  
Subject: Chemistry  
Semester I

Max.hrs: 3 hrs.                                Max. Marks: 75

Part A- comprises of ten very short answer questions from all units. Attempt any seven.  
(It’s a compulsory question)  
2x7 = 14 marks

Part B- comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.  
10x4 = 40 marks

Total marks for End Semester Examination  
Internal Assessment  
54 marks  
21 marks

Total  
75 marks

Paper I Inorganic Chemistry BCHE (H) 101  
45 Hrs (3hrs/Week)

Unit I

Ionic bond  
General characteristics, types of ions, size effects, Radius ratio and coordination number, Madelung constant, Born Haber cycle, Application of lattice energy, polarizing power and polarisability, Fajan’s rule, Hydration energy, solubility of ionic compounds, defects in structures, Frenkel and Schottky defects, non-stiochiometric compounds.  
Metallic Bond: Qualitative idea of free electron, valence bond and band theories, semiconductors and insulators, conduction in ionic solids, electrical and magnetic properties of solids, introduction to superconductors and superconductivity.

Unit II

Covalent Bond  
General characteristics, Valence bond theory and its limitations, Directional characteristics of covalent bond, Resonance and resonance energy, hybridization involving s, p and d- orbitals, Valence shell electron pair repulsion (VSEPR) theory for H₃O⁺, NH₃, H₂O, SF₄, ClF₃, ICl₃, Shapes of simple inorganic molecules and ions, Dipole moment, percentage ionic character from dipole moment and electronegativity difference.

Unit III

Molecular Orbital Theory  
Detailed description of linear combination of atomic orbital (LCAO), homonuclear molecules (H₂, He₂, B₂, C₂, N₂, O₂, F₂) and heteronuclear diatomic molecules (CO, NO) and their ions, comparison of valence bond theory and molecular orbital theories, multicentre bonding in electron deficient molecules, bond strength and bond energy.

Unit IV

Weak interactions  
Hydrogen bond, theories of hydrogen bonding: Valence bond treatment, weak intermolecular forces of attraction, Van der Waals forces.

Chemistry of noble gases  
Position in the periodic table, discovery, isolation, important compounds of noble gases with special reference to xenon compounds: synthesis, bonding and their stereochemistry
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester I

Paper II Organic Chemistry BCHE (H) 102

45 Hrs (3hrs/Week)

Unit I

Mechanism of organic reaction
Free radical and ionic reactions, homolytic and heterolytic bond breaking, electrophiles and nucleophiles. Types of organic reactions, energy considerations, transition states, reactive intermediates—Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes with examples. Assigning formal charges on intermediates and other ionic species. Method of determination of reaction mechanism

Unit II

Alkanes
Nomenclature of branched and unbranched alkanes, classification of carbon atoms in alkanes, Isomerism in alkanes sources, methods of formation (with special reference of Wurtz reaction, Kolbe reaction, Corey House reaction and decarboxylation of carboxylic acids.) Physical properties and chemical reactions of alkanes, Mechanism of free radical halogenations of alkanes, orientation, reactivity and selectivity.

Cycloalkanes

Unit III

Alkenes

Unit IV

Dienes
Nomenclature and classification, isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reactions, 1,2 and 1,4- additions, Diels-Alder reaction.

Alkynes
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester I

Paper III Physical Chemistry BCHE (H) 103 45 Hrs (3hrs/Week)

Unit I

Gaseous States

Ideal Gases

Real Gases

Unit – II

Liquid State

Unit – III

Solid State

Unit – IV

Chemical Kinetics
Rate, Initial rate, Specific rate, Rate constant and units. Method of determination of initial rate. Order, molecularity and stoichiometry of the reaction. Methods of determination of order of a reaction. Derivation of integrated rate equations-zero order, first order, second order and third order. Graphical applications of these equations for the determination of rate constant. Effect of temperature on the rate constant. Arrhenius equation, energy of activation and its determination. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.
UNIT I

Basic concepts in Analytical Chemistry-
Cleaning and calibration of glassware, significant figures, error in analysis, accuracy and precision,
Compilation and reliability of results, mean, mode, median, standard deviation, T, Q and F test,
correction in analysis.

UNIT II

Volumetric Analysis
Basic Principles of Volumetric Analysis. Simple theoretical background of following types of titrations:
Iodometric & iodimetric titrations: Basic principle, application in standardization of iodine by CuSO₄-
hypo and H₃AsO₃.
Redox titrations: Standard potential, SHE, electrochemical series, emf calculations, internal & external
indicators, applications in K₂Cr₂O₇ oxidation reaction.
Complexometric titrations: Types of EDTA titrations, masking and de-masking agents, metal ion
indicator, application in estimation of total hardness.
Precipitation titrations: Basic principle, application in Volhard’s method

UNIT-III

Gravimetric Analysis
Principles of Gravimetric Analysis, Precipitation Methods, Super saturation & Precipitation formation
and purity of precipitate, Coprecipitation , Postprecipitation, Conditions for precipitation, Precipitation
from homogenous solution, washing and ignition of the ppt, masking and demasking agent.

Unit IV

Solvent Extraction
Principles and Process of solvent extraction, Distribution law & Partition Coefficient, liquid- liquid
extraction, factors favoring solvent extraction, choice of solvent for solvent extraction, stripping,
Solid liquid extraction, organic reagents used in solvent extraction.
### BACHELOR OF SCIENCE (Hons.)
#### Subject: Chemistry
#### Semester I

**Chemistry Practical**  
BCHE (H) 151  
60 hrs (4 hr/week)

### Practical

Note: Total marks for each semester practicals is 150, which include 90 marks for ESE and 60 marks for internal assessment.

<table>
<thead>
<tr>
<th>Duration 7 hours</th>
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<th>Max. Marks: 90</th>
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<td>Experiment no. 1</td>
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<td>Experiment no. 2</td>
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<tr>
<td>Experiment no. 3</td>
<td>Physical Chemistry</td>
<td>25 marks</td>
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<tr>
<td>Record</td>
<td></td>
<td>11 marks</td>
</tr>
<tr>
<td>Viva</td>
<td></td>
<td>11 marks</td>
</tr>
</tbody>
</table>

### Inorganic Chemistry

Qualitative: To analyse the given mixture containing six radicals (three acidic radicals and six basic radicals including combination test)

### Organic Chemistry

Determination of mixed melting point, melting point and crystallization

Identification of functional groups in organic compounds and preparation of suitable derivative: unsaturation, alcoholic (-OH), phenolic (-OH), aldehydic, ketonic, carboxylic, ester, carbohydrate, nitro, amido, amino, sulphonlic acids and halogen derivatives.

### Physical Chemistry

1. Determine the relative viscosity of a liquid by using viscometer
2. Determine the relative surface tension of a liquid by using stalagmometer
3. Determine the heat of neutralization of an acid by alkali
4. To determine the percentage composition of a given mixture (non-interacting systems) by viscosity method.
5. To determine the percentage composition of a given binary mixture by surface tension method.

### Viva-Voce and Record
The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

**SCHEME OF EXAMINATION**

*(Semester Scheme)*

**Examination scheme**

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Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration.

Each Practical / Lab work 7 hours duration.

The number of papers and the maximum marks for each paper/ practical shall be shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory part as well as practical part of a subject separately.

Note: Maximum marks for a theory paper is 75 marks which include 54 marks for ESE and 21 marks for internal assessment.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester II

Max. hrs: 3 hrs.  Max. marks : 75

Part A - comprises of ten very short answer questions from all units. Attempt any seven.
(It’s a compulsory question)  2x7 = 14 marks

Part B - comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.
10x4 = 40 marks

Total marks for End Semester Examination
Internal Assessment

54 marks
21 marks

Total  75 marks

Paper I Inorganic Chemistry BCHE (H) 201  45 Hrs (3hrs/Week)

Unit I

s-Block Elements
Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems and introduction to alkyls and aryls.

Unit II

Periodicity of p- block elements
Comparative study of p-block elements and group trends, electronic configuration, physical and chemical properties, atomic and ionic radii, ionization potentials, electron affinity, electronegativity and oxidation states, catenation, inert pair effect.

Unit III

Compounds of p- block elements
Hydrides of boron, diborane and higher boranes, borazines, borohydrides, fullerenes, carbides, flurocarbons, silicates (structural principle), silicones, oxygen fluorides, peracids of sulphur, tetrasulphur tetranitride, basic properties of halogens, interhalogen compounds and polyhalides.

Unit IV

d-block elements
Chemistry of elements of first transition series
Electronic configuration and comparative study with respect to atomic and ionic radii, oxidation states, ionization potential, Redox potential, oxidation state diagrams on the basis of redox potentials, binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry, metallic nature, magnetic properties, catalytic activity, colour and spectral properties of transition metal ions.

Chemistry of second and third transition series
Electronic configuration, general characteristics, comparative treatment with their 3-d analogues in respect to atomic and ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.
Unit I

**Stereochemistry of organic compounds**
Concept of isomerism, type of isomerism. Optical isomerism; elements of symmetry, molecular chirality, Enantiomers, Chiral and achiral molecules with two stereogenic centres, distereomers Threo, and erythro diastereomers, meso compounds. Resolution of enantiomers, inversion, retention and racemisation, Relative and absolute configuration, sequence rule, D&L and R&S system of nomenclature.

**Geometrical isomerism**
Determination of configuration of geometrical isomers, E&Z- system of nomenclature, geometric isomerism in oximes and in alicyclic compounds.

**Conformational isomerism**

Unit II

**Arenes and Aromaticity**

**Aromaticity**
The Huckel’s rule and its application

Unit III

**Aromatic Electrophilic Substitution**

Unit IV

**Alkyl and Aryl Halides**
Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanism of nucleophilic substitution, reaction of alkyl halides, SN1 and SN2 reaction with energy profile diagram. Methods of formation of aryl halides, nuclear and side chain reaction. The addition-elimination and the elimination addition mechanism of nucleofilic aromatic substitution reaction. Relative reactivities of alkyl halides v/s allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester II

Paper III Physical Chemistry BCHE (H) 203 45 Hrs (3hrs/Week)

Unit – I

Thermodynamics

Unit – II

Thermochemistry

Unit – III

Solutions

Unit – IV

Colloidal State
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester II

Paper IV Analytical chemistry BCHE (H) 204

45 Hrs (3hrs/Week)

Unit I

Distillation methods of organic solvents, steam, fractional, vacuum and molecular distillations, monomers and monostates, Analysis of oils and fats, saponification value, iodine value, RM value, acid value.

Quantitative estimation of following functional groups- alcoholic, phenolic, carboxylic acids and unsaturated groups (olefinic & acetylenic).

Unit II

Polarimetry
Basic principle, instrumentation, experimental techniques, determination of (a) specific rotation of a substance(b) concentration of substance & applications. An elementary idea of refractrometry, interferometry- circular dichroism & optical rotatory dispersion.

Unit III

Water pollutants and their analysis
Water analysis pollutants, analysis of water for dissolved oxygen, BOD and COD, Biological Treatment methods, prevention of water pollution by treatment of industrial wastes with special reference to cement industry, fertilizer industries and dyeing industries.

Unit IV

Air Pollution
General consideration types of air pollutants, unit of measurement sampling monitoring and analysis of CO and SO$_2$ in atmosphere effect of air pollutants on plants and human health method for pollution control, specially for pollution by automobiles.
BACHELOR OF SCIENCE
Subject: Chemistry
Semester II

Chemistry Practical          BCHE(H) 251          60 hrs (4 hr/week)

Practicals

Note: Total marks for each semester practicals is 150, which include 90 marks for ESE and 60 marks for internal assessment.

<table>
<thead>
<tr>
<th>Experiment no.</th>
<th>Subject</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inorganic Chemistry</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>Organic Chemistry</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
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<td>11</td>
</tr>
<tr>
<td></td>
<td>Viva</td>
<td>11</td>
</tr>
</tbody>
</table>

Inorganic Chemistry

Qualitative: To analyze the given mixture containing six radicals (three acidic radicals and six basic radicals including fluoride, borate, oxalate and phosphate) and excluding insoluble.

Organic Chemistry

Identification of simple organic compounds by functional group determination and preparation of suitable derivatives.

Physical Chemistry

1. To study the solubility curve of phenol in water and hence study the effect of separate addition of substances such as naphthalene, potassium chloride and acetic acid.
2. Determination of pH of different buffer solutions and evaluate the pk of an acid by Handerson equation.
3. Determine the molecular complexity of benzoic acid in benzene by distribution law.
4. Determine the heat of reaction and verify Hess’s law.

Viva-Voce and Record
The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

**SCHEME OF EXAMINATION**

*(Semester Scheme)*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Sr. No.</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
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Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 7 hours duration

The number of papers and the maximum marks for each paper/ practical shall be shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory part as well as practical part of a subject separately.

Note: Maximum marks for a theory paper is 75 marks which include 54 marks for ESE and 21 marks for internal assessment.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester III

Max hrs: 3 hrs.                                                Max. marks: 75

**Part A** - comprises of ten very short answer questions from all units. Attempt any seven.
(It’s a compulsory question)  2 x 7 = 14 marks

**Part B** - comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.
10 x 4 = 40 marks

**Total marks for End Semester Examination**

Internal Assessment

21 marks

Total 75 marks

**Paper I Inorganic Chemistry BCHE (H) 301**

45 Hrs (3hrs/Week)

**Unit I**

**Acids and Bases**
Theories: Arrhenius (Water- ion system), Bronsted- Lowry (The proton donor acceptor system), The Lux-Flood (oxide ion concept), solvent system and solvolysis and lewis concepts of acids and bases (The electron donor acceptor concept). Classification of acids and bases as hard and soft. Pearson’s HSAB concept, acid- base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

**Unit II**

**Non-aqueous solvents**
Physical properties of solvent, types of solvent and their general characteristics, reactions in non-aqueous solvents with reference to liq. NH₃, liq. SO₂ and liq.HF.

**Unit III**

**Oxidation and Reduction**
redox potential data and their analysis, redox stability in water, disproportionation, frost, latimer and pourbaix diagrams, application of redox data in the extraction of the elements.

**Unit IV**

**Chemistry of Lanthanide Elements**
General study, occurrence and isolation, Electronic configuration, oxidation states and ionic radii, lanthanide contraction and its consequences, magnetic properties, complex formation of lanthanide compounds.

**Chemistry of Actinides**
General study, chemistry of separation of Np, Pu and Am from U, electronic configuration, oxidation states, magnetic properties, complexation behavior, comparison of lanthanide and actinide. Superheavy elements.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester III

Paper II Organic Chemistry BCHE (H) 302 45 Hrs (3hrs/Week)

Unit I

Alcohols
Dihydric alcohols- nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidation cleavage [Pb(OAc)₄ and HIO₄] and pinacol- pinacolone rearrangement.
Trihydric alcohols- nomenclature , methods of formation, chemical reactions of glycerol.

Unit II

Phenol

Unit III

Aldehyde and ketones
Nomenclature and structure of the carbonyl group. Synthesis of aldehyde and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyde and ketones using 1, 3 dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties, reactivity, Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, perkin and Knoevenagel condensations, condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction, use of acetals as protecting group, oxidation of aldehyde and ketones, Cannizzaro reaction, Bayer Villiger oxidation of ketones, MPV, Clemmensen’s reduction, Wolf Kishner reduction, LiAlH₄ and NaBH₄ reduction, Halogenation of enolizable ketones.

Unit IV

Organic synthesis via Enolates
Acidity of α hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethylacetoacetate; The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3- dithianes, alkylation and acylation of enamines.

Ethers and epoxides
Nomenclature of ethers and methods of their formation, physical properties, chemical reactions-cleavage and auto oxidation, Ziesel ’s method. Synthesis of epoxides. Acid and base- catalyzed ring opening of epoxides, orientation of epoxide ring opening; reactions of Grignard and organolithium reagents with epoxides.
Unit –I

**Electrochemistry-I**
Electrolytic conduction, specific, equivalent and molar conductivities and their determination. Variation of conductance with dilution. Effect of temperature, pressure, solvent and viscosity on conductance. Kohlrausch’s law and its applications in determination of

1. Degree of dissociation and dissociation constants of weak acids
2. Solubility of sparingly soluble salts
3. Hydrolysis constant
4. Ionic product of water

Unit –II

**Electrochemistry-II**

Unit –III

**Thermodynamics**

Unit –IV

**Spectroscopy**

**Raman spectrum:** Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester III

Paper IV Analytical chemistry BCHE (H) 304 45 Hrs (3hrs/Week)

Unit I

Chromatography
Principles of absorption and partition chromatography, techniques and application of column, paper and thin layer chromatography, Electrophoresis and its applications in separation of amino acids.

Unit II

Ion Exchange Methods
General discussion, action of ion exchange resins, column operation, experimental techniques, types of ion exchange resins, determination of the following pairs by ion exchange techniques: (a) chloride and bromide (b) nickel and cobalt.

Unit III

Conductometric titrations
The basis of conductometric titrations, Apparatus and measurement, application of conductometric titrations, High frequency titration, advantages of the techniques, some examples of high frequency titrations.

Unit IV

Potentiometric titrations
Introduction, electrodes, instrumentation, Potentiometric titrations, differential Potentiometric titrations, automatic Potentiometric titrations, location of end points, determination of some metals through Potentiometric titrations.
BACHELOR OF SCIENCE
Subject: Chemistry
Semester III

Chemistry Practical  BCHE (H) 351  60 hrs (4 hr/week)

Practicals

Note: Total marks for each semester practicals is 150, which include 90 marks for ESE and 60 marks for internal assessment.

<table>
<thead>
<tr>
<th>Duration 7 hours</th>
<th>Inorganic Chemistry</th>
<th>25 marks</th>
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<tr>
<td>Experiment no. 1</td>
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<td>Experiment no. 3</td>
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<td>25 marks</td>
</tr>
<tr>
<td></td>
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<td>10 marks</td>
</tr>
<tr>
<td></td>
<td>Viva</td>
<td>10 marks</td>
</tr>
</tbody>
</table>

Inorganic Chemistry

Quantitative (Gravimetric) Any Three

(a) Estimation of Barium (as Sulphate)
(b) Lead (as Chomate)
(c) Copper (as Cuprous thiocyanate)
(d) Nickel (as Dimethyl glyoximate)
(e) Silver (as Chloride)
(f) Zinc (as Zinc ammonium phosphate)
(g) Magnesium (as Magnesium hydrogen phosphate)

OR

Volumetric

1. Determination of total hardness of water.
2. Iodometric titrations
3. Complexometric titrations.

Organic Chemistry

Quantitative analysis

a) Determination of neutralization equivalent of an acid
b) Determination of the saponification value of an ester/oil
c) Estimation of glucose by titration with Fehling solution/Benedict solution

Physical Chemistry

1. Determination of the transition temperature of the given substance by thermometric method.
2. To find out the strength of strong acids by titrating it against strong base by conductometric method.
3. To find out the strength of weak acids by titrating it against strong base by conductometric method.
4. To find out the strength of strong acids by titrating it against weak base by conductometric method.

Viva-Voce and Record
The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

**SCHEME OF EXAMINATION**

*(Semester Scheme)*

**Examination scheme**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Paper</th>
<th>ESE</th>
<th>CIA</th>
<th>Total</th>
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<tr>
<td>2.</td>
<td>Practical</td>
<td>60%</td>
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<td>100</td>
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</table>

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 7 hours duration

The number of papers and the maximum marks for each paper/ practical shall be shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory part as well as practical part of a subject separately.

Note: Maximum marks for a theory paper is 75 marks which include 54 marks for ESE and 21 marks for internal assessment.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester IV

Max.hrs: 3 hrs.                                  Max. Marks: 75

Part A - comprises of ten very short answer questions from all units. Attempt any seven. (It’s a compulsory question) 7x2 = 14 marks

Part B - comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit. 10x4 = 40 marks

Total marks for End Semester Examination
Internal Assessment

54 marks
21 marks

Total 75 marks

Paper I Inorganic Chemistry BCHE (H) 401 45 Hrs (3hrs/Week)

Unit I

Coordination Compounds
Werner’s coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds. Magnetic properties of transition metal complexes. Types of magnetic behaviour, determination of magnetic susceptibility, orbital contribution of magnetic moments, spin-only formula, L-S coupling, correlation of $\mu_s$ and $\mu_{\text{eff}}$ values, applications of magnetic moment data for 3d metal complexes.

Unit II

Theories of Coordination compounds
Valence bond theory of transition metal complexes, limitations of valence bond theory, crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal–field parameters, jahn teller effect, application of crystal-field stabilization energy in explaining ionic radii of first transition series, heat of hydration of divalent ions of first transition series.

Unit III

Electronic spectra of transition metal complexes
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, orgel-energy level diagram for $d^1$ and $d^9$ states, discussion of the electronic spectrum of [Ti(H2O)$_6$]$^{3+}$ complex ion.

Unit IV

Thermodynamic and kinetic aspects of metal complexes
A brief outline of Thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester IV

Paper II Organic Chemistry BCHE (H) 402 45 Hrs (3hrs/Week)

Unit I
Electromagnetic spectrum: Absorption spectra (UV)
Ultraviolet absorption spectroscopy- absorption laws (Beer- Lambert Law) molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of solvents on transitions, effect of conjugation, concept of chromophore and auxochrome. Bathochromic, hypsochromic and hyperchronic and hypochromic shifts, UV spectra of conjugated enes and enones.

Infrared IR absorption spectroscopy
Molecular vibrations, Hookes law, selection rules, intensity and position of IR bands, measurement of IR spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit II

Carboxylic acids
Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, Comparison of acidity with phenols, preparation of carboxylic acids, reactions of carboxylic acids – Hell Volhard Zelinisky reaction, synthesis of acid chlorides, esters and amides, reduction mechanism of decarboxylation.
Aromatic carboxylic acids: synthesis and reaction of benzoic acid, salicylic acid.
Method of formation and chemical reaction of α, β- and γ-hydroxy acids, malic, tartaric and citric acids.
Methods of formation and chemical reactions of α, β- unsaturated monocarboxylic acids.
Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

Unit III

Carboxylic acids derivatives
Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides, relative stability of acyl derivatives. Physical properties, inter conversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions, mechanism of esterification and hydrolysis (acidic and basic).

Fats, oils and detergents
Natural fats edible and industrial oils of vegetable origin common fatty acids, glycerides, hydrogenation of unsaturated oils. saponification value, iodine value, acid value, soaps, synthetic detergents, alkyl and aryl sulphonates.

Unit IV

Organic compounds of nitrogen
Preparation and chemical reaction of nitroalkanes. mechanism of nucleophilic substitution in nitro arenes and their reduction in acidic, neutral and alkaline medium, picric acid. structure and nomenclature of amines, physical properties, stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines, structural features effecting basicity of amines.Amines salts as phase transfer catalyst, preparation of alkyls and aryl amines (reduction of nitro compounds, nitriles). Gabriel- Pthalimide reaction, Hofmann bromamid reaction, reaction of amines.

Aryl diazonium salts
Preparation and synthetic transformations,azo coupling, diazomethane and its applications.
Quantum Chemistry

Photochemistry
Consequences of light absorption, phosphorescence, fluorescence, chemiluminescence and photosensitization. Absorption of light, Laws of photochemistry: Grothus-Draper law, Stark-Einstein law. Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non radiative process (internal conversion, inter system crossing). Quantum yield of photochemical reactions, reasons for high and low quantum yield of photochemical equations. Primary and secondary processes, photochemical reactions such as (1) \( \text{H}_2 + \text{Cl}_2 \) reaction (2) photolysis of ammonia.

Nuclear Chemistry

Tracer techniques:
Radiocarbon dating
Reaction mechanism
Biology and medicine
Unit I

Spectrophotometric titrations
Basic principle, instrumentation, experimental techniques, spectrophotometric analysis of Fe(III), Co (I), Ni (II), Fe(II) in presence of Al(III) with EDTA.

Nephelometry & turbidimetry
General discussion, instrumentation, some nephelometry determination (a) sulphate (b) phosphate.

Unit II

Flame emission and atomic absorption spectroscopy
Basic principle, instrumentation, nebulization, flames and flame temperatures, interferences, flame spectrometric techniques.

Unit III

Atomic emission spectrography
Spectroscopic sources, instruments for emission spectrographic analysis, qualitative and quantitative spectrographic analysis, qualitative spectrographic analysis of a non ferrous alloy and complex organic mixture.

Unit IV

Thermal Analysis
Thermogravimetry (TG), instrumentation, application, differential thermal analysis (DTA) and differential scanning colorimetry, instrumentation.
BACHELOR OF SCIENCE
Subject: Chemistry
Semester IV

Chemistry Practical BCHE (H) 451 60 hrs (4 hr/week)

Practicals

Note: Total marks for each semester practicals is 150, which include 90 marks for ESE and 60 marks for internal assessment.

Duration 7 hours Max. Marks: 90
Experiment no. 1 Inorganic Chemistry 25 marks
Experiment no. 2 Organic chemistry 20 marks
Experiment no. 3 Physical Chemistry 25 marks
Record 10 marks
Viva 10 marks

Inorganic chemistry

Inorganic preparations (any four) and its characterization of coordination compounds
(a) Cuprous chloride, Cu₂Cl₂
(b) Tetrammine copper (II) sulphate
(c) Pyridine complex of Copper
(d) Sodium trioxalato ferrate (III)
(e) Sodium trioxalato chromate (III)

Organic Chemistry

Simple one step organic preparation (any four)
1. Preparation of Acetanilide from aniline
2. Preparation of aspirin from salicylic acid
3. Preparation of o- and p-bromoacetanilide from acetanilide
4. Preparation of o- and p-bromoaniline from o- and p-bromoacetanilide
5. Partial reduction of m-dinitrobenzene into m-nitroaniline
6. Preparation of methyl orange from sulphanilic acid
7. Preparation of m-dinitrobenzene from nitrobenzene

Physical Chemistry

1. To find the velocity constant of the hydrolysis of methyl acetate catalysed by an acid.
2. To determine the order of saponification of ethyl acetate by NaOH.
3. To find out the strength of HCl and acetic acid in mixture of both, by titrating it against a strong alkali (NaOH) by conductivity method.
4. Determination of equivalent conductivity of an electrolyte at different dilutions

Viva-Voce and Record
### BACHELOR OF SCIENCE

**Subject: Chemistry**  
**Semester V**

<table>
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<th>Paper Title</th>
<th>Type of paper</th>
<th>Contact Hours Per semester</th>
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## SCHEME OF EXAMINATION

*(Semester Scheme)*

### Examination scheme

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Each Practical /Lab work 7 hours duration

The number of papers and the maximum marks for each paper/ practical shall be shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory part as well as practical part of a subject separately.

Note: Maximum marks for a theory paper is 75 marks which include 54 marks for ESE and 21 marks for internal assessment.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester V

Max.hrs: 3 hrs.                                                                                                          Max. Marks: 75

Part A- comprises of ten very short answer questions from all units. Attempt any seven.                              7x2= 14marks
(It’s a compulsory question)

Part B- comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit. 10x4 = 40 marks

Total marks for End Semester Examination
Internal Assessment

54marks
21marks

Total  75 marks

Paper I  Inorganic Chemistry  BCHE (H) 501

Unit I

Inorganic Polymers
Silicones
Classification, preparation and Structure of silicones, silicon resin, silicon rubber, silicon fluid, industrial application of silicons.

Phosphazenes
Preparation, properties, substitution reaction and structure.

Unit II

Metal Clusters
Higher boranes, carboranes, metalloboranes and metallocarboranes, metal carbonyls and halide clusters, compounds with metal-metal multiple bonds.

Metal carbonyls
Preparation, properties and bonding of transition metal carbonyls. Detailed study of mononuclear and poly nuclear carbonyls.

Unit III

Organometallic compounds
Definition and classification of organometallic compounds, synthesis, properties and structures of organometallic compounds of magnesium, aluminium, tin and lead.

Unit IV

Metal Ligand Bonding
Limitations of crystal field theory, molecular orbital theory: octahedral, tetrahedral and square planar complexes, π- bonding and molecular orbital theory.
UNIT I

**Nuclear Magnetic Resonance (NMR) Spectroscopy**
Proton magnetic resonance $^1$H-NMR spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin spin splitting and coupling constant, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromo ethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

**Unit II**

**Organometallic Compounds:**
- Organomagnesium compounds: The Grignard reagent- formation, structure and chemical reactions,
- Organozinc compounds: Formation and chemical reactions,
- Organolithium compound: Formation and chemical reactions.
- Organo sulphur compounds: nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids.

**Unit III**

**Heterocyclic compounds**
Nomenclature, five and six membered heterocyclic compounds, aromatic character, preparation, reactions chemical reactivity, orientation(electrophilic and nucleophilic substitution reaction) basicity of pyrrole, furan, thiophene and pyridine. Condensed five and six membered heterocyclic compounds, aromatic character, preparation and reactions of indole, quinoline and isoquinoline.

**Unit IV**

**Polymers and Polymerization**
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester V

Paper III Physical Chemistry  BCHE (H) 503  45 Hrs (3hrs/Week)

Unit – I

Quantum mechanics
Schrodinger’s wave equation for particle in three dimensional boxes, H-atom, quantum number and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.
M.O. Theory, basic ideas- criteria for forming M.O. from A.O., construction of M.O.’s by LCAO-H$_2^+$ on, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of sigma, sigma* and pi, pi* orbitals and their characteristics. Hybrid orbitals – sp,sp$^2$, sp$^3$, calculation of coefficients of A.O.’s used in these hybrid orbitals. Introduction to Valence bond model of H$_2$, comparison of M.O. and V.B. model.

Unit – II

Systems of variable composition: Partial molar quantities, dependence of thermodynamic parameters on compositions; Gibbs Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases. Free energy of mixing and spontaneity, equilibrium between ideal gases and a pure condensed phase.

Unit – III

Physical properties and molecular structure
Optical activity, polarization (Clausius Mossotti equation), orientation of dipole in the electric field, dipole moment, induced dipole moment, measurement of dipole moment, temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetism.

Unit – IV

Electrochemistry
Electrolytic and Galvanic cells – Reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F of cell and its measurements, computation of cell E.M.F. Calculation of thermodynamic quantities of cell reaction( G, H and k), Polarization
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester V

Paper IV Analytical Chemistry BCHE (H) 504 45 Hrs (3hrs/Week)

Unit I

**Electrogravimetry**
Theory, electrode reactions, overpotential, completeness of deposition, electrolytic separation of metals, character of the deposit, electrolytic separation of metals with controlled cathode potential. Electrolytic determinations at constant current-Copper and Lead. Electrolytic determinations with controlled cathode potential – Antimony, copper, lead and tin in an alloy.

**Coulometry**
Coulometry at controlled potential, separation of Ni and Co by coulometric analysis at controlled potential, coulometry at constant current, coulometry titrations.

Unit II

**Polarography**
Principle and experimental set-up. Diffusion current and Half-wave potential – Qualitative and quantitative applications of polarography in analytical chemistry.

(i) Wave height concentration graph
(ii) Internal standard (Piloton method)
(iii) Standard addition method
(iv) Use of polarography in : (i) Zn and Cu in brass

(ii) Dissolved oxygen in the sample.

Unit III

**Amperometry**
Amperometric titrations, technique of amperometric titrations with the dropping mercury electrode, titration with the rotating platinum micro electrode, biamperometric titrations.

(a) Modified Voltammetric methods: Current sampled (TAST) Polarography, Pulse Polarography, Differential pulse polarography, Cyclic Voltammetry, Sinusoidal Alternating current polarography, Stripping Voltammetry.

Unit IV

**Mass spectrometry**
Instrumentation and technique, Elementary idea about electron impact, chemical ionization and matrix assisted laser desorption ionization (MALDI), mass spectrometer techniques. Principle of fragmentation, molecular ion peak, base peak, isotopic peaks and metastable ion peak. Determination of molecular formula, mass spectra of alkanes, alkenes, alkynes, cycloalkanes and arenes, alcohols and ethers, aldehydes and ketones.
BACHELOR OF SCIENCE  
Subject: Chemistry  
Semester V

Chemistry Practical BCHE(H) 551  
60 hrs (4 hr/week)

Practicals

Note: Total marks for each semester practicals is 150, which include 90 marks for ESE and 60 marks for internal  
assessment.

Duration 7 hours  
Max. Marks: 90

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<th>Subject</th>
<th>Marks</th>
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<td>Qualitative analysis</td>
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<td>10</td>
</tr>
<tr>
<td></td>
<td>Viva</td>
<td>10</td>
</tr>
</tbody>
</table>

Inorganic chemistry

1. Qualitative analysis of mixture containing six radicals, one of which should be a rare ion. The 
mixture may contain radicals of any combinations including interfering acid radicals and insoluble.
2. Quantitative estimation of any three of the following mixture by volumetric and gravimetric 
methods.
   a. Copper-Zinc
   b. Zinc-Nickel
   c. Silver-Copper
   d. Silver-Nickel
   e. Silver-Zinc
   f. Copper-Nickel

Organic Chemistry

Analysis of an organic mixture containing two solid components using water, NaHCO₃, NaOH and ether for separation and preparation of suitable derivatives.

Physical Chemistry

pH metric titrations

1. To find out the strength of strong acids by titrating it against strong base
2. To find out the strength of strong acids by titrating it against weak base
3. To find out the strength of weak acids by titrating it against strong base
4. To find out the strength of HCl and acetic acid in a mixture of both by titrating against NaOH

Viva-Voce and Record
### BACHELOR OF SCIENCE

**Subject: Chemistry**  
**Semester VI**

<table>
<thead>
<tr>
<th>Paper code</th>
<th>Paper Title</th>
<th>Type of paper</th>
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*(Semester Scheme)*

**Examination scheme**

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<td>70%</td>
<td>30%</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>Practical</td>
<td>60%</td>
<td>40%</td>
<td>100</td>
</tr>
</tbody>
</table>

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 7 hours duration

The number of papers and the maximum marks for each paper/ practical shall be shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory part as well as practical part of a subject separately.

Note: Maximum marks for a theory paper is 75 marks which include 54 marks for ESE and 21 marks for internal assessment.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester VI

Max. hrs: 3 hrs.                                          Max. Marks: 75

Part A- comprises of ten very short answer questions from all units.
(It’s a compulsory question)  2x7 = 14 marks
Part B- comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.
Total marks for End Semester Examination
10x4 = 40 marks
Internal Assessment
54 marks
21 marks
Total 75 marks

PaperI Inorganic Chemistry  BCHE(H) 601 45 Hrs (3hrs/Week)

Unit- I

Nuclear Chemistry I
Fundamental particles of nucleus (Nucleon), concept of nuclides, representation of nuclides, isotopes, isobars and isotones with specific examples. Applications of radioisotopes, size concept in nucleus and atom. Qualitative idea of the stability of nucleus (n/p ratio).

Unit- II

Nuclear Chemistry II
Shell and liquid drop model, natural and artificial radioactivity, disintegration series, disintegration rates, half life, average life, nuclear binding energy, mass defects, Einstien’s mass energy relations, artificial transmutation, nuclear reactions, spallations, nuclear fission and nuclear fusion, nuclear reactors, hazards of radioactive emanations.

Unit- III

Bioinorganic chemistry
Role of bulk and trace metal ions in biological systems with special reference to Na, K, Mg, Ca, Fe, Cu and Zn.
Metalloporphyrins: Chlorophyll and their role in photosynthesis. Haemoglobin and myoglobin and their role as oxygen carriers.

Unit- IV

Nitrogen fixation
Mechanism, nitrogenase enzyme, dinitrogen complexes as models for nitrogen fixation.
Metalloenzymes
General discussion of enzymes, functions of metal ions, inhibition (explanation based on coordination chemistry), carboxypeptidase-A and cytochrome-c.
UNIT I

**Mass Spectrometry**
Introduction, instrumentation, factors influencing fragmentation, ion analysis, ion abundance, fragmentation modes, Mass spectral fragmentation of simple organic compounds- alkanes, Primary alcohols, aliphatic ketones, aldehydes and carboxylic acids. Types of peak: molecular ion peak, isotopic peak, base peak, metastable peak, doubly charged ion, McLafferty rearrangement, retro Diels-Alder fragmentation, Nitrogen rule.

UNIT II

**Carbohydrates**
Introduction, classification, constitution and reaction of glucose and fructose, mutarotation and its mechanism, Cyclic structure, pyranose and furanose forms, Haworth projection formulae, Configuration of monosaccharide. Determination of ring size, conformation analysis of monosaccharides, Epimerization, chain lengthening and chain shortening of aldose, inter conversion of aldoses and ketoses. Disaccharides: Structure of maltose, lactose and sucrose
Polysaccharides: Structure of starch and cellulose

UNIT III

**Amino acids, peptides, proteins and nucleic acid**

**Nucleic acids**
Introduction, Constituents of nucleic acid (RNA and DNA), Ribonucleosides and, ribonucleotides. The double helical structure of DNA.

UNIT IV

**Synthetic dyes**
Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluoroscein, Alizarin and Indigo.

**Drugs**
Chemotherapy, Synthetic uses and side effect of analgesics: Aspirin, Phenacetin, Paracetamole.
Antimalarials: Chloroquine, Plasmoquine.
Antibiotic: Chloramphenicol (chloromycetin).
Sulpha drugs and their structure. Synthesis of sulphadiazine, sulphapyridine, sulphasoxazole, sulphaguanidine and sulphamethazole.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester VI

Paper III Physical Chemistry BCHE (H) 603 45 Hrs (3hrs/Week)

Unit I

Electrochemistry

Unit II

Macromolecules
Linear, branches network and homopolymer
Polymer classification- condensation polymers and addition polymers, number average and weight average, molecular weight determination methods of polymers by (I) Osmotic pressure (II) Viscosity (III) Light scattering. Properties of macromolecules.

Chemical Kinetics

Unit III

Phase Equilibrium
Solid solutions: Introduction to phase rule including one component and two component systems, compound formation with congruent melting point (Mg-Zn) and benzophenone- dimethylamine incongruent melting point NaCl-H$_2$O, picric acid and benzene, FeCl$_3$-H$_2$O and CuSO$_4$-H$_2$O system.
Liquid-liquid mixtures: ideal liquid mixtures, Roault’s law and Henry’s law, non-ideal system, azeotropes HCl-H$_2$O and ethanol-water system.
Particularly miscible liquids: phenol water, triethylamine water, nicotine water system. Effect of impurities on consolute temperature.

Unit IV

Surface Phenomena, Micelles
Surface active agents, classification of surface active agents, micellization, hydrophilic interactions, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion, binding to micelles, thermodynamic of micellization, phase separation and mass action models, solubilization, micro-emulsions, reverse micelles.

Adsorption: Gibb- adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (electro kinetic phenomenon), catalytic activity at surfaces; Electrode/electrolyte interface.
BACHELOR OF SCIENCE (Hons.)
Subject: Chemistry
Semester VI

Paper IV Analytical Chemistry BCHE (H) 604 45 Hrs (3hrs/Week)

Unit I

Gas Chromatography and HPLC

Unit II

Diffraction Pattern
Fundamental principles, instrumentation, use of X-ray, electron and neutron in diffractometry and applications of X-ray, electron and neutron diffractometry in biological and as analytical techniques. Applications of X-rays in C.T. scan.

Unit III

Automated methods of analysis

Unit IV

NMR Spectroscopy
Theory of nuclear magnetic resonance, experimental methods of NMR spectroscopy, experimental methods of NMR spectroscopy, applications of Proton NMR including applications in MRI technique.
BACHELOR OF SCIENCE
Subject: Chemistry
Semester VI

Chemistry Practical  BCHE (H) 651  60 hrs (4 hr/week)  Practicals

Note: Total marks for each semester practicals is 150, which include 90 marks for ESE and 60 marks for internal assessment.

Duration 7 hours  Max. Marks: 90

Experiment no. 1  Inorganic Chemistry
- Inorganic preparation  15marks
- Quantitative analysis  15marks

Experiment no. 2  Organic Chemistry  20marks

Experiment no. 3  Physical Chemistry
- Record  10 marks
- Viva  10 marks

Inorganic chemistry
1. Inorganic preparations (any four) and its characterization of coordination compounds
   a. Bis(dimethylglyoximato)nickel(II) complex
   b. Tetraamminecopper(II) sulphate
   c. cis-Potassium diaquodioxalatochromate(III) complex
   d. Hexaamminenickel(II) chloride
   e. Prussian blue
   f. Chloropentamminecobalt(III) chloride
   g. Carbonatotetraamminecobalt(III) nitrate
2. Analysis of any three of the following
   a. Available chlorine in bleaching powder
   b. Water analysis for total hardness
   c. Analysis of two components
   d. Analysis of cement for Ca, Al or Mg
   e. MnO₂ in pyrolusite

Organic chemistry
Two step preparation of simple compounds (any three)
   a. Preparation of p-aminoazabenzene from aniline
   b. Preparation of p-nitroaniline from acetanilide
   c. Preparation of syn-tribromobenzene from aniline
   d. Preparation of m-nitro aniline from nitrobenzene
   e. Preparation of acetylacetone from acetophenone (Beckmann Rearrangement)
   f. Preparation of anthranillic acid from phthalic anhydride
   g. Preparation of eosin from phthalic anhydride

Physical chemistry
A. Potentiometry (Multimeters may also be used)
   1. To find out the strength of acid by titrating against alkali.
   2. Determination of dissociation constants of weak acids
   3. Determination of number of electrons involved in a cell reaction by setting up concentration cell
   4. Determination of transport number of anion by e.m.f. measurements

B. Spectrophotometer experiments or colorimetric experiments:
   Verify Lambert-Beer’s law and determine the concentration of the given aqueous solution of unknown concentration of the salt.

C. Kinetics:
   1. Determine the effect of ionic strength on the rate of persulphate iodide reaction
   2. Determination of molecular weight by Rast Camphor method
   3. Determination of concentration of given solution of H₂SO₄ by measuring heat changes during dilution
   4. Compare the cleansing power of two samples of detergent by surface tension measurements

Viva-Voce and Record