PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc., Chemistry from 2019-2020

FIRST YEAR- SEMESTER I

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>COURSE TYPE</th>
<th>HPW</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 101</td>
<td>Ability Enhancement Compulsory Course AECC-1</td>
<td>ES</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>BS 102</td>
<td>English</td>
<td>CC-1A</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>BS 103</td>
<td>Second language</td>
<td>CC-2A</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>BS 104</td>
<td>Optional I</td>
<td>DSC-1A</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 105</td>
<td>Optional II</td>
<td>DSC-2A</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 106</td>
<td>Optional III- Chemistry - I</td>
<td>DSC-3A</td>
<td>4T</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Laboratory Course – I</td>
<td></td>
<td>3P</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(Qualitative Analysis - Semi Micro Analysis of Mixtures)</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td></td>
<td>31</td>
<td>25</td>
</tr>
</tbody>
</table>

FIRST YEAR- SEMESTER II

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>COURSE TYPE</th>
<th>HPW</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 201</td>
<td>Ability Enhancement Compulsory Course AECC-2</td>
<td>BCS</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>BS 202</td>
<td>English</td>
<td>CC-1B</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>BS 203</td>
<td>Second language</td>
<td>CC-2B</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>BS 204</td>
<td>Optional I</td>
<td>DSC-1B</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 205</td>
<td>Optional II</td>
<td>DSC-2B</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 206</td>
<td>Optional III- Chemistry - II</td>
<td>DSC-3B</td>
<td>4T</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Laboratory Course – II</td>
<td></td>
<td>3P</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(Quantitative Analysis – Titrations)</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td></td>
<td>31</td>
<td>25</td>
</tr>
</tbody>
</table>

SECOND YEAR- SEMESTER III

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>COURSE TYPE</th>
<th>HPW</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 301</td>
<td>i) Safety Rules in Chemistry Laboratory and Lab Reagents</td>
<td>SEC-1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>ii) Remedial methods for pollution, drinking water and Soil fertility</td>
<td>SEC-2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>BS 302</td>
<td>English</td>
<td>CC-1C</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>BS 303</td>
<td>Second language</td>
<td>CC-2C</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>BS 304</td>
<td>Optional I</td>
<td>DSC-1C</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 305</td>
<td>Optional II</td>
<td>DSC-2C</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 306</td>
<td>Optional III- Chemistry - III</td>
<td>DSC-3C</td>
<td>4T</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Laboratory Course – III</td>
<td></td>
<td>3P</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(Synthesis of Organic compounds)</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td></td>
<td>31</td>
<td>25</td>
</tr>
</tbody>
</table>

SECOND YEAR- SEMESTER IV

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>COURSE TYPE</th>
<th>HPW</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 401</td>
<td>i) Materials and their Applications</td>
<td>SEC-3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>ii) Chemistry of Cosmetics and Food Processing</td>
<td>SEC-4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>BS 402</td>
<td>English</td>
<td>CC-1D</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>BS 403</td>
<td>Second language</td>
<td>CC-2D</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>BS 404</td>
<td>Optional I</td>
<td>DSC-1D</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 405</td>
<td>Optional II</td>
<td>DSC-2D</td>
<td>4T+3P=7</td>
<td>4+1=5</td>
</tr>
<tr>
<td>BS 406</td>
<td>Optional III- Chemistry - IV</td>
<td>DSC-3D</td>
<td>4T</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Laboratory Course – IV</td>
<td></td>
<td>3P</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(Qualitative Analysis of Organic Compounds)</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td></td>
<td>31</td>
<td>25</td>
</tr>
</tbody>
</table>

Unit-I (Inorganic Chemistry)  

**S1-I-1. Chemical Bonding**  

Ionic solids- lattice and solvation energy, solubility of ionic solids, Fajan’s rule, polarity and polarizability of ions. VSPER Theory - Common hybridization-sp, sp², sp³, sp³d, sp³d² and sp³d³, shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of bond. Criteria for orbital overlap. LCAO concept. \( \pi \) and \( \sigma \) overlapping. Concept of Types of molecular orbitals- bonding, antibonding and non bonding. MOED of homonuclear diatomics - H₂, N₂, \( O_2^- \), \( O_2^{2-} \), F₂ (unhybridized diagrams only) and heteronuclear diatomics CO, \( CN^- \), NO, \( NO^+ \) and HF. Bond order, stability and magnetic properties.

**S1-I-2. P-Block Elements I**  

Group–13: Structure of diborane and higher Boranes (\( B_4H_{10} \) and \( B_5H_{9} \)), Boron nitrogen compounds (\( B_3N_3H_6 \) and BN), Lewis acid nature of BX₃.  


Unit - II (Organic Chemistry)  

**S1-O-1: Structural Theory in Organic Chemistry**  

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

**S1-O-2: Acyclic Hydrocarbons**  

**Alkanes**– Methods of preparation: From Grignard reagent, Kolbe synthesis. Chemical reactivity - inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

**Alkenes** - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev’s rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markonikov’s rule, addition of H₂O, HOX, \( H_2SO_4 \) with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov’s addition). Oxidation (cis – additions) – hydroxylation by \( KMnO_4 \), OsO₄, \( \ldots \)
anti addition- peracids (via epoxidation), hydroboration, ozonolysis – location of double bond. Dienes – Types of dienes, reactions of conjugated dienes – 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diels – Alder reaction.

**Alkynes**– Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of X₂, HX, H₂O (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation).

**Aromatic Hydrocarbons**

4h

Introduction to aromaticity: Huckel’s rule – Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Craft’s alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

**Unit – III (Physical Chemistry)**

15h(1 hr/week)

**S1-P-1:** Atomic structure and elementary quantum mechanics

3 h

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck’s radiation law, photoelectric effect, Limitations of classical mechanics, Compton effect, de Broglie’s hypothesis. Heisenberg’s uncertainty principle.

**S1-P-2:** Gaseous State

5 h


**S1-P-3:** Liquid State and Solutions

4 h

**Liquid State**


**Solutions**

3 h

Unit - IV (General Chemistry)  
15h(1 hr/week)

S1-G-1. General Principles of Inorganic Qualitative Analysis  
6 h

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions - $CO_3^{2-}$, $Cl^-$, $Br^-$, $SO_4^{2-}$, $PO_4^{3-}$, $BO_3^{3-}$, $CH_3COO^-$, $NO_3^-$. Interfering ions. Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations ($Hg_2^{2+}$, $Ag^+$, $Pb^{2+}$) with flow chart and chemical equations. Principle involved in separation of group II & IV cations. General discussion for the separation and identification of group II ($Hg^{2+}$, $Pb^{2+}$, $Bi^{3+}$, $Cd^{2+}$, $Sb^{3+}$), III ($Al^{3+}$, $Fe^{3+}$), IV ($Mn^{2+}$, $Zn^{2+}$) individual cations with flow chart and chemical equations. General discussion for the separation and identification of group V individual cations ($Ba^{2+}$, $Sr^{2+}$, $Ca^{2+}$) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations ($Mg^{2+}$, $NH_4^+$).

S1-G-2. Isomerism  
5 h


Conformational analysis: Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, $n$-butane, 1,2- dichlooroethane,2-chloroethanol .Cyclic compounds: Baeyer’s strain theory, Conformational analysis of cyclohexane

Cis-trans isomerism: E-Z-Nomenclature

S1-G-3: Solid state Chemistry  
4 h


References
General reference: B.Sc I Year Chemistry : Semester I, Telugu Academy publication, Hyd
Unit- I
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.

Unit II
3. Organic Chemistry by Bruice Yuranis Powla.
5. Organic Chemistry by M. Jones, Jr.
8. General Organic chemistry by Sachin Kumar Ghosh.
9. Organic Chemistry by C N pillai

Unit III
1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara.
3. Text Book of Physical Chemistry by Puri and Sharma.
5. Physical Chemistry through problems by S.K. Dogra.
7. Elements of Physical Chemistry by Lewis Glasstone.

Unit IV
1. Qualitative analysis by Welcher and Hahn.
2. Vogel’s Qualitative Inorganic Analysis by Svehla.
7.Text Book of Physical Chemistry by Soni And Dharmahara..
8. Text Book of Physical Chemistry by Puri And Sharma.

Laboratory Course

Paper I - Qualitative Analysis - Semi micro analysis of mixtures
Analysis of two anions (one simple, one interfering) and two cations in the given mixture.
Anions: \(CO_3^{2-}, SO_3^{2-}, S^{2-}, Cl^-, Br^-, I^-, CH_3COO^-, NO_3^-, PO_4^{3-}, BO_3^{3-}, SO_4^{2-}\)
Cations: \(Hg^{2+}, Ag^+, Pb^{2+}, Hg^{2+}, Pb^{2+}, Bi^{3+}, Cd^{2+}, Cu^{2+}, As^{3+/5+}, Sb^{3+/5+}, Sn^{2+/4+}, Al^{3+}, Cr^{3+}, Fe^{3+}, Zn^{2+}, Ni^{2+}, Co^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^+\)

45h (3 h / week)
B.Sc I Yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER II
Paper – II
Chemistry – II

Unit-I (Inorganic Chemistry) 15 h (1 hr/week)
S2-I-1 P-block Elements -II 7 h

Oxides: Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed (c) sub oxide  (d) peroxide  (e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Oxy acids: Structure and acidic nature of oxyacids of B, C, N, P, S, Cl and I. Redox properties of oxyacids of Nitrogen: HNO₂ (reaction with FeSO₄, KMnO₄, K₂Cr₂O₇), HNO₃ (reaction with H₂S, Cu), HNO₄ (reaction with KBr, Aniline), H₂N₂O₂ (reaction with KMnO₄). Redox properties of oxyacids of Phosphorus: H₃PO₂ (reaction with HgCl₂), H₃PO₃ (reaction with AgNO₃, CuSO₄). Redox properties of oxyacids of Sulphur: H₂SO₃ (reaction with KMnO₄, K₂Cr₂O₇), H₂SO₄ (reaction with Zn, Fe, Cu), H₂S₂O₃ (reaction with Cu, Au), H₂SO₅ (reaction with KI, FeSO₄), H₂S₂O₈ (reaction with FeSO₄, KI). Redox properties of oxy acids of Chlorine.

Interhalogens: Classification- general preparation- structures of AB, AB₃, AB₅ and AB₇ type and reactivity.

Poly halides- Definition and structure of ICl₂⁻, ICl₄⁻ and I₃⁻.
Pseudohalogens: Comparision with halogens.

S2-I-2: Chemistry of Zero group elements 2 h
Isolation of noble gases, Structure, bonding and reactivity of Xenon compounds – Oxides, Halides and Oxy-halides. Clathrate compounds and Anomalous behavior of He (II)

S2-I-3: Chemistry of d-block elements 6 h

Unit - II (Organic Chemistry) 15h(1 hr/week)
S2-O-1: Halogen compounds 4 h

S2-O-2: Hydroxy compounds and ethers  6 h

**Alcohols:** Preaparation: 1°, 2° and 3° alcohols using Griganard reagent, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/ZnCl₂ (Lucas reagent), esterification, oxidation with PCC, alk. KMnO₄, acidic dichromates, conc. HNO₃ and Oppenauer oxidation (Mechanism).

**Phenols:** Preapartion: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide.

Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution; halogenations, Riemer Tiemann reaction (Mechanism), Kolbe reaction (Mechanism), Gattermann-Koch reaction, Azo-coupling reaction, Schotton-Boumann raction, Houben-Hoesch condensation.

**Ethers:** Nomenclature, preparation by (a) Williamson’s synthesis (b) from alkenes by the action of conc. H₂SO₄. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of conc. H₂SO₄ and HI.

S2-O-3 Carbonyl compounds  5 h

Preparation of aldehydes & ketones from acid chloride,1,3-dithianes, nitriles and from carboxylic acids. Special methods of preparing aromatic aldehydes and ketones by (a) Oxidation of arenes (b) Hydrolysis of benzal halides Physical properties – absence of Hydrogen bonding. Reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of (a) NaHSO₃ (b) HCN (c) RMgX  (d) NH₃  (e) RNH₂  (f) NH₂OH  (g) PhNHNH₂ (h) 2,4-DNP (Schiff bases). Addition of H₂O to form hydrate, chloral hydrate (stable), addition of alcohols - hemi acetal and acetal formation. Cannizaro reaction. Oxidation reactions – KMnO₄ oxidation and auto oxidation, reduction – catalytic hydrogenation, mechanism of Clemmenson’s reduction, Wolff-kishner reduction, Meerwein Pondoff Verly reduction. Reduction with LAH, NaBH₄.

**Unit - III (Physical Chemistry)**  15h(1 hr/week)

S2-P-1: Electrochemistry  15 h

Electrical transport – conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kholrausch’s law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald’s dilution law - its uses and limitations. Debye-Huckel-Onsagar’s equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf’s method for attackable electrodes. Applications of conductivity measurements: Determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. Electro motive force (EMF) of a cell and its measurement. Computation of EMF. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble

Unit – IV (General Chemistry) 15 h (1 hr/week)

S2-G-1: Theory of Quantitative Analysis 6 h
Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, coprecipitation and post precipitation. Determination of Ni²⁺

S2-G-2: Stereoisomerism 5 h

S2-G-3: Dilute Solutions & Colligative Properties 4 h
Dilute Solutions, Colligative Properties, Raoult’s law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.
References

**General reference:** B.Sc I Year Chemistry : Semester II, Telugu Academy publication, Hyd

**Unit I**

2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.

**Unit II**

3. Organic Chemistry by Bruice Yuranis Powla.
5. Organic Chemistry by M. Jones, Jr
8. General Organic chemistry by Sachin Kumar Ghosh.
9. Organic Chemistry by C N pillai

**Unit III**

1. Physical chemistry by P W Atkins
2. Principles of physical chemistry by Prutton and Marron.
3. Text Book of Physical Chemistry by Soni and Dharmahara.
4. Text Book of Physical Chemistry by Puri and Sharma
5. Text Book of Physical Chemistry by K. L. Kapoor
7. Elements of Physical Chemistry by Lewis and Glasstone.
8. Material science by Kakani & Kakani

**Unit IV**

2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..
6. Practical chemistry by V K Ahluwalia, Sunitha Dhingra and AdarshGulati.

**Laboratory Course**

45hrs (3 h / week)

**Paper II- Quantitative Analysis**

**Acid - Base titrations**

2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.
4. Estimation of Alkali content in Antacid using HCl.
5. Estimation of $NH_4^+$ by back titration

**Redox Titrations**
1. Determination of Fe(II) using K$_2$Cr$_2$O$_7$
2. Determination of Fe(II) using KMnO$_4$ with sodium oxalate as primary standard.
3. Determination of Cu(II) using Na$_2$S$_2$O$_3$ with K$_2$Cr$_2$O$_7$ as primary standard

**Complexometric Titrations**
1. Estimation of Mg$^{2+}$
2. Estimation of Cu$^{2+}$

---

**B.Sc II Yr CHEMISTRY**

**SEMESTER WISE SYLLABUS**

**SEMESTER III**

**Paper-III**

Chemistry - III

---

**Unit-I (Inorganic Chemistry)**

15 h (1 hr/week)

**S3-I-1: Chemistry of f-block elements:** 5 h


**S3-I-2: Coordination Compounds-I** 6 h


Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism – (a) geometrical isomerism in (i) square planar metal complexes of the type [MA$_2$B$_2$], [MA$_2$BC], [M(AB)$_2$], [MABC]. (ii) Octahedral metal complexes of the type [MA$_4$B$_2$], [M(AB)$_2$B$_2$], [MA$_3$B$_3$] using suitable examples, (b) Optical isomerism in (i) tetrahedral complexes [MABCD], (ii) Octahedral complexes [M(AB)$_2$B$_2$], [M(AB)$_3$] using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.
S3-I-3: Metal carbonyls and Organometallic Chemistry 4 h
Metal carbonyls: Preparation and properties of Ni(CO)$_4$, Structural features of Ni(CO)$_4$, Fe(CO)$_5$, Fe$_2$(CO)$_9$, Fe$_3$(CO)$_{12}$ and Cr(CO)$_6$. 18 valence electron rule. Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al.

Unit - II (Organic Chemistry) 15h(1 hr/week)

S3-O-1: Carboxylic acids and derivatives 5 h

S3-O-2: Nitrohydrocarbons 3 h

S3-O-3: Amines, Cyanides and Isocyanides 7 h
Amines: classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman’s bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitrination, oxidation of aryl and 3° Amines, diazotisation. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl)- Sandmeyer and Gatterman reaction, by fluorine (Schiemann’s reaction), by iodine, CN, NO$_2$, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides: Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent
reduction iv) oxidation.

Unit III (Physical Chemistry)  

15 h (1 hr/week)

S3-P-1: Thermodynamics –I  

10 h


S3-P-2: Thermodynamics-II  

5 h


Unit – IV (General Chemistry)  

15 h (1 hr/week)

S3-G-1 Evaluation of analytical data  

4 h

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors. Problems based on mean, median, range, standard deviation

S3-G-2: Carbanions-I  

5 h

Introduction, acidic nature of α-hydrogens and tautomerism in carbonyl compounds, nitro hydrocarbons, ethyl acetoacetate, diethyl malonate. Terminal alkynes. Stability of carbanions. Reactions: Aldol reaction, Perkin reaction, Benzoin condensation, haloform reaction, conversion of smaller alkynes to higher alkynes.
S3-G-3: Phase Rule

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibb’s Phase rule, phase equilibria of one component system – water system. Phase equilibria of two-component system – Solid-Liquid equilibria, simple eutectic –Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H₂O system.

References

General reference: B.Sc II Year Chemistry : Semester III, Telugu Academy publication, Hyd

Unit- I

Unit- II
8. Organic Chemistry by M. Jones, Jr

Unit III
2. Text Book of Physical Chemistry by Soni and Dharmahara. Suthan Chand and Sons.(2011)
5. Colloidal and surface chemistry, M. Satake, Y. Hayashi, Y. Mido, S.A.Iqbal and

Unit IV
Laboratory Course

Paper III (Organic Synthesis)  

1. Synthesis of Organic compounds:
   Acetylation: Acetylation of salicylic acid, Benzylation of Aniline.
   Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene and m-dinitro benzene.
   Halogenation: Preparation of p-bromo acetanilide, Preparation of 2,4,6-tribromo phenol
   Oxidation: Preparation of benzoic acid from benzyl chloride.
   Esterification: Preparation of n-butyl acetate from acetic acid.
   Methylation: Preparation of - naphthyl methyl ether.
   Condensation: Preparation of benzilidine aniline and Benzaldehyde and aniline.
   Diazotisation: Azocoupling of β-Naphthol.

2. Microwave assisted synthesis of Asprin – DEMO (demonstration only)
Unit-I (Inorganic Chemistry) 15h (1 h/week)
S4-I-1: Coordination Compounds –II


Applications of coordination compounds: Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization – Ziegler Natta catalyst d) water softening.

S4-I-2:Bioinorganic Chemistry 4 h

Semester-IV

Unit - II (Organic Chemistry) 15h(1 hr/week)
S4-O-1: Carbohydrates
Introduction: Classification and nomenclature. Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain penta hydroxy aldehyde structure. Number of optically active, isomers possible for the structure, configuration
of glucose based on D-glyceraldehyde as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure. Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: Arabinose to D-glucose, D-mannose (Kili\-ani – Fischer method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. D-glucose to D-arabinose by Ruff’s degradation. Aldohexose(+) (glucose) to keto\-hexose (−) (fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

**S4-O-2: Amino acids and proteins**


**S4-O-3: Heterocyclic Compounds**

Introduction and definition: 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems – Numbering. Aromatic character


**Unit III (Physical Chemistry)**

**S4-P-1: Chemical Kinetics**

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples. Order of a reaction. First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Examples- Decomposition of H₂O₂ and decomposition of oxalic acid, Problems. Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for second order rate constant, examples-
Saponification of ester, $2O_3 \rightarrow 3O_2$, $C_2H_4+H_2 \rightarrow C_2H_6$. Characteristics of second order reaction, units for rate constants, half-life period and second order plots. Problems

**S4-P-2: Photochemistry**

4 h


**Unit III (General Chemistry)**

15h (1 hr/week)

**S4-G-1: Theories of bonding in metals**

4 h

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

**S4-G-2: Carbanions-II**

5 h

Mannich reaction, Michael addition and Knoevengeal condensation Synthetic applications of Aceto acetic ester. Acid hydrolysis and ketonic hydrolysis: Preparation of ketones, monocarboxylic acids and dicarboxylic acids Malonic ester– synthetic applications. Preparation of (i) substituted mono carboxylic acids and (ii) substituted dicarboxylic acids.

**S4-G-3: Colloids & Surface Chemistry**

6 h


**References**

**General reference:** B.Sc II Year Chemistry : Semester IV, Telugu Academy publication, Hyd

**Unit- I**

Unit- II
7. Organic Chemistry by M. Jones, Jr

Unit III
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand &sons.(2011)

Unit IV
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey,
7. Fundamentals of organic synthesis and retrosynthetic analysis by Ratna Kumar Kar,
   CBA,(2014)
8. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav, Pragati Prakashan, 2010

Laboratory Course

Paper IV-
Qualitative Analysis of Organic Compounds: 45hrs (3 h/week)
Qualitative analysis: Identification of organic compounds through the functional group analysis -
ignition test, determination of melting points/boiling points, solubility test, functional group tests
and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, urea,
thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene.
Unit I: Laboratory Safety Rules and Regulations 15 h (1 hr/week)

UNIT 2: Preparation of Lab Reagents 15 h (1 hr/week)
Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation titrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc). Preparation of buffers – pH 10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents : Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bayer’s reagent, Benedict’s solution, Bromine water, Dimethyl glyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch’s reagent, Nessler’s reagent, Neutral FeCl3, Schiff’s reagent, Silver nitrate solution, Sodium carbonate solution , Sodium hydroxide (Caustic soda) solution, Starch solution, Tollén’s reagent. (reference work and submission of assignments). Charts preparation depicting course content.

RECOMMENDED BOOKS

3. Chemistry Reagent Manual Prepared by Chemistry Department, SGTB Khalsa College under DBT’s Star College Scheme, University of Delhi (Available: online)

[Course objectives (CO)]: To improve the skills of students in the application of theory and practical knowledge. To fill the gap between theory and practicals. To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents]
UNIT I: Remedial Methods for Pollution Prevention and control of air pollution  
15 h (1 hr/week)


UNIT II: Drinking Water and Soil Fertility Standards and Analysis  
15 h (1 hr/week)


Introduction to Soil Chemistry- Basic Concepts. Effect of pH on nutrient availability. Macronutrients and their effect on plants -Carbon, Hydrogen, Oxygen, Nitrogen and Phosphorus other macronutrients-Calcium, Magnesium and Sulfur. Micronutrients and their effect on plants. Boron (B4 O7 2-), Copper (Cu2+), Iron (Fe2+, Fe3+) Manganese (Mn2+) Molybdenum (MoO4 2- ) Zinc (Zn2+) Cobalt (Co2+) Chlorine (Cl- ) and Others. Determination of soil nitrogen by Kjeldahl method- Illustration through charts (Or) demonstration of experiment. Visit to nearby agricultural forms and interaction with farmers. Discussion with farmers on the use of Soil Analysis Kits.
References

2. Remedial methods for pollution, drinking water and soil fertility standards, Author: Dr G. Vanajatha.
3. Remedial methods for pollution, drinking water and soil fertility standards, Telugu version, Authors: Dr N. Yogi Babu, Dr. G. Vanajatha, M. Srilatha.
4. Environmental Pollution, download.nos.org/333courseE/10.pdf
5. CFC Replacements, butane.chem.uiuc.edu/pshapley/Environmental/L21/3.html
7. Acid Rain Effects - Buildings - Chemistry chemistry.elmhurst.edu/vchembook/196buildings.html
10. Side-effects of harmful radiation from mobile phones and towers pib.nic.in/newsite/printrelease.aspx?relid=116304
12. Chemical Waste That Impact on Aquatic Life or Water Quality blog.idrenvironmental.com/chemical-waste-that-impact-on-aquatic-life-or-waterquality
13. Trees and Your Environment - Clean Air Gardening www.cleanairgardening.com/plantingtrees
14. Water quality and common treatments for private drinking water . extension.uga.edu/publications/detail.html?number=b939
15. Soil chemistry https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDFdownloads/2.2-soil-chemistry.pdf
16. Soil Analysis-Determination of Available Nitrogen ... - Amrita Virtual Lab vlab.amrita.edu/?sub=2&brch=294&sim=1551&cnt=1
18. Determination of chemical oxygen demand of wastewater www.pharmaguideline.com › quality control › test
Unit – I: Types of Materials 15 h (1 hr/week)


Field Work- Collection of Metal Alloy Samples.

Types and Applications of Ceramics: Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements, and advanced ceramics. Glasses: Compositions and Characteristics of Some of the Common Commercial Glasses; Properties and applications of glass ceramics - preparation of charts depicting various types of glass and their use. Clay products: Structural clay products and the white wares. Refractories: Compositions of four Common Ceramic Refractory Materials, fireclay, silica, basic refractories ex. MgO and special refractories ex. Alumina and Zirconia

Cements: Classification, preparation of cement and the setting process; quick setting cements; applications.

Field Work- Visit to industries and collection of samples of materials

Unit – II: Types of Polymers and Applications 15 h (1 hr/week)

Classification of Polymeric materials based on application: Coatings, adhesives, films, foams with examples Polymer Additives: Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants with examples.


Field Work- Visit to Dental Clinics and interaction with Doctors regarding materials used in Dental treatments.

Smart materials: Shape memory alloys- definition and examples (Ni-Ti alloys, Cu based alloys), applications. Conducting polymers: - Introduction, Electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene).

References
Unit-I: Chemistry of Cosmetics and Perfumes

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, 2-phenyl ethyl alcohol. Demonstration experiments or illustration of experimental procedures through charts for the preparation of talcum powder, shampoo and vanishing cream. Analysis of deodorants and antiperspirant - Aluminum, Zinc, Boric acid, Chloride and Sulphide.

Unit-II: Food Processing and Food Adulteration

Food processing: Introduction, methods for food processing, additives and preservatives. Food processing- impact on nutrition, analysis of calcium in milk by complexometric titration, spectrophotometric analysis of iron in foods, Spectrophotometric identification and determination of caffeine and benzoic acid in soft drinks. Field Work -Visit to Food Industries. Food adulteration: Adulterants in some common food items and their identification: Pulses, chilli powder, turmeric powder, milk, honey, spices, food grains and wheat flour, coffee powder, tea leaves, vegetable oil, ghee, ice creams, tomato sauce. Field Work-Collection of adulterated food samples, demonstration of a minimum of five experiments for testing adulterants in food items.

References

10. Applied Chemistry K. Bhagavathi Sundhar, MJP publishers.