



MAHARAJA KRISHNAKUMARSINHJI BHAVNAGAR UNIVERSITY  
(With effect from Academic Year 2020-2021)

**B.Sc. CHEMISTRY**

**SEMESTER-I**

<b>SR. NO.</b>	<b>Subject Code</b>	<b>PAPER NO.</b>	<b>NAME OF THE PAPER</b>	<b>TOTAL MARKS EXT.+INT *= TOTAL</b>	<b>PASSING STANDARD EXT. + INT.* = TOTAL</b>	<b>TOTAL TEACHING HOURS</b>	<b>CREDITS</b>
1	22835	CHECC-103	Fundamental and Applied Chemistry-I (Theory)	70+30=100	28+12=40	15 WEEKS X 4 HOURS =60	04
2	22836	CHECC-104	Practical [Based on paper CHECC- 103]	100	40	15 WEEKS X 4 HOURS =60	02

**SEMESTER-II**

<b>SR. NO.</b>	<b>Subject Code</b>	<b>PAPER NO.</b>	<b>NAME OF THE PAPER</b>	<b>TOTAL MARKS EXT.+INT*= TOTAL</b>	<b>PASSING STANDARAD EXT.+INT* = TOTAL</b>	<b>TOTAL TEACHING HOURS</b>	<b>CREDITS</b>
1	22837	CHECC -203	Fundamental and Applied Chemistry-II (Theory)	70+30=100	28+12=40	15 WEEKS X 4 HOURS =60	04
2	22838	CHECC -204	Practical [Based on paper CHECC-203]	100	40	15 WEEKS X 4 HOURS = 60	02

\*INTERNAL MARKS: 30

(1) Internal Test 15 marks (10marks LQ and 05 marks SQ)

(2) Assignment/Presentation 10marks

(3) Seminar/Presence 05 marks

Total 30 marks



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B.Sc. (CHEMISTRY)  
SEMESTER-I

Paper No: CHECC-103

Title of the Paper: Fundamental and Applied Chemistry-I

Marks: Semester Terminal Examination: 70 Marks Credits: 04

Continues Internal Evaluation: 30 Marks

Total Teaching Hours: 60Hours

Unit No.	Detailed Syllabus	Marks/Weight
1	<b>Thermodynamics:</b> Introduction and basic concepts of thermodynamics: system, surroundings, etc., types of system, intensive and extensive properties, state function, thermodynamic process, concept of heat and work, first law of thermodynamics: statement, definition of internal energy and enthalpy, Joule's law, calculation of $W$ , $q$ , $\Delta U$ and $\Delta H$ for the expansions of ideal gases under isothermal and adiabatic conditions for reversible process, limitations of the first law of thermodynamics, second law of thermodynamics, different statements of second law of thermodynamics, definition of entropy and free energy, significance of entropy in a reaction, Carnot theorem, Carnot cycle and its efficiency, thermodynamic scale of temperature, numericals based on first and second law of thermodynamics.	18
2	<b>(A) Metallurgy:</b> introduction, occurrence, definition of metallurgy, principles of metallurgy, basic metallurgical operations and metallurgy process, general methods involved in extraction of metals, flow sheet diagram, extraction processes with chemical reactions, chemical properties and uses of Cr, Ni and Zn. important compounds of Cr, Ni and Zn. <b>(B) Purification of water:</b> impurities present in water due to different sources. <i>treatment for drinking water:</i> sedimentation, coagulation, filtration, sterilization, chlorination, <i>treatment for Sewage water:</i> properties of sewage water and BOD, treatment of sewage water, <i>treatment for Industrial waste water:</i> properties of industrial waste water, treatment of industrial waste water by reverse osmosis and electro dialysis,	18



3	<p><b>(A) Detection and estimation of elements present in organic compounds:</b> detection of carbon and hydrogen, detection of nitrogen, sulphur and halogens (Lassaigne's test), detection of phosphorus, estimation of carbon and hydrogen by Liebig's combustion method with example, estimation of nitrogen by</p>	17
	<p>Kjeldahl's method, its limitation and examples, estimation of nitrogen by Dumas' method with examples, estimation of halogen by Carrius method with examples, estimation of sulphur by Carrius method with examples, estimation of phosphorus by Carrius method with examples.</p> <p><b>(B) Valence Bond Theory:</b> Valence bond theory of chemical bonding, explanation for formation of covalent bond by Lewis theory, limitations of Lewis theory, V.B. theory for formation of covalent bond, overlapping of s-s, s-p and p-p orbitals, explanation of H<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>O and HF molecules by V.B.T., limitations of V.B.T.</p>	
4	<p><b>(A) Stereochemistry:</b> Definition of stereochemistry, definition of isomerism, classification of isomerism, definition of optical isomerism, optical isomerism of compounds containing one and two asymmetric carbon atoms with proper illustrations, enantiomers, D-L and R-S nomenclatures, racemic mixtures, racemisation, definition of geometrical isomerism, geometrical isomerism of organic compounds with ethylenic double bond, importance of stereochemistry.</p> <p><b>(B) IUPAC nomenclature:</b> IUPAC nomenclature of mono and Bi-functional aliphatic, alicyclic and aromatic organic compounds such as alkanes, alkenes, alkynes, alkylhalides, nitro, alcohols, aldehydes, ketones, carboxylic acids, esters, amines, nitriles, ethers and amides.</p> <p><b>(C) Molecular Orbital Theory:</b> Formation of bonding and anti bonding molecules orbitals, bond order, order of energy for molecular orbitals, Molecular orbital diagram of homo nuclear diatomic molecules, Molecular orbital diagram of molecules and ions such as C<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, F<sub>2</sub> and H<sub>2</sub>, H<sub>2</sub><sup>+</sup>, He<sub>2</sub>, He<sub>2</sub><sup>+</sup>.</p>	17



**: REFERENCE BOOKS :**

01. Basic Inorganic chemistry, -*F.A.Cotton, G.Wilkinson*; John Wiley & Sons
02. Quantum chemistry, - *Iran.N.Levine* ; P H I Learning Private Ltd.
03. Modern Inorganic chemistry, -*G.D.Parkes*; Longmans, Green & Co. London.
04. Modern Inorganic Chemistry, - *R.D.Madan*; S.Chand & Company Ltd.
05. Organic Chemistry vol-I , - *I.L.Finar* ; Longman Scientific & Technical Publication.
06. Organic Chemistry vol-II , - *I.L.Finar* ; Longman Scientific & Technical publication.
07. Reaction Mechanism & Reagents in Organic Chem., - *G.R.Chatwal* ; Himalaya Pub. house.
08. Organic reaction mechanism by Ahluwalia parasar.: Narosa Publishing House.
09. Text book of Physical Chemistry , - *Glasstone* ; London Macmillan & Company Ltd.
10. Physical Chemistry, - *A.J.Mee* ; The English Language Book Society.
11. Physical Chemistry , - *Barrow*; McGraw Hill Book Co.
12. Principles of Physical Chemistry, - *S. H. Maron, C. F. Pruton* ; Oxford and IBH Pub. Co.
13. Physical Chemistry , - *William F. Sheehan* ; Prentice hall of India Pvt. Ltd.
14. Physical Chemistry , - *Frank.H.Mac Dougall* ; New York The Macmillan Company.
15. Shrev's Chanical Process Industries, -*R. Norris Shreve, J.A.Brink, Jr.*; McGraw-Hill Kgakusha.
16. Industrial Chemistry, -*Dr B.K.Sharma*; Goel Publication house.
17. Roger's Industrial Chemistry, -*C.C.Furnas*; D.Van Nostrand compony, Inc.
18. Industrial Chemistry, -*William Thornton* ; John Wiley & Sons.



**B.Sc. (CHEMISTRY)  
SEMESTER-I**

**Paper No: CHECC -104**

**Title of the Paper: Practical [Based on paper CHECC -103]**

**Marks: Semester Terminal Examination: 100 Marks Credits: 02**

**Detailed Curriculum for Practical**

*Students have to prepare their Practical journals of Chemistry for Laboratory work and they have to submit certified journals in the University practical exams. Students are not allowed in the laboratory without certified journals in the University practical examination.*

Detailed Syllabus for Chemistry Practical	Teaching Hours
<b>Organic Spotting;</b> Identification of organic compounds having mono functional group, including Lassaigne's test and physical constant. (Minimum 14 compounds)	60
<b>Volumetric analysis:</b> To determine the molarity and gm/lit of NaOH and H <sub>2</sub> SO <sub>4</sub> by using 0.1 M HCl solution. To determine the molarity and gm/lit of Na <sub>2</sub> CO <sub>3</sub> and NaHCO <sub>3</sub> solution in mixture by using 0.1 M HCl solution. To determine the molarity and gm/lit of NaOH and Na <sub>2</sub> CO <sub>3</sub> solution in mixture by using 0.05 M H <sub>2</sub> SO <sub>4</sub> solution. To determine the amount of Cu <sup>+2</sup> by 0.12 M Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> solution by using starch as indicator.	

**REFERENCE BOOKS :**

1. Vogel's Textbook of practical organic chemistry, 5th Edition by B. S. Furniss et al.
2. Vogel qualitative Inorganic Analysis by G. Svehla.:universities press.
3. Organic qualitative analysis by Mann sunder.
4. Comprehensive practical organic chemistry, V. K. Ahuwalia.



**B.Sc. (CHEMISTRY)**  
**SEMESTER-II**

**Paper CHECC: 203**

**Title of the Paper: Fundamental and Applied Chemistry-II**

**Marks: Semester Terminal Examination: 70 Marks Credits: 04**

**Continous Internal Evaluation: 30 Marks**

**Total Teaching Hours: 60 Hours**

<b>Unit No.</b>	<b>Detailed Syllabus</b>	<b>Marks/Weight</b>
1	<p>(A) <b>Surface chemistry:</b> Introduction of surface chemistry: concept of adsorption, difference between adsorption and absorption, physical adsorption and chemical adsorption, Freundlich's adsorption isotherm and its limitations, Langmuir's adsorption isotherm, applications of adsorption.</p> <p>(B) <b>Colloids:</b> definition and classification of colloids, solids in liquids (sols), preparation and purification (lyophobic), general, optical and electrical properties, stability of colloids, liquid in liquid (emulsions), types of emulsions, emulsifiers, preparation and uses, liquid in solid (gels), preparation and uses of colloids.</p>	18
2	<p>(A) <b>Building materials:</b> <i>Cement:</i> constituting compound in cement, composition of Portland cement, manufacture of Portland cement. <i>Glass:</i> Glass and its general properties, manufacture of glass, variety &amp; glasses and their application. <i>Ceramics:</i> Manufacture of ceramics, classification of ceramics like Acid, Base and Neutral. Chemical reactions involved in manufacture of cement, ceramic and glass.</p> <p>(B) <b>Chemistry of water:</b> Hard water and soft water, types of hardness of water, effect of hard water in boiler operation, scale and sludge formation and its prevention, priming and foaming and its prevention, caustic embrittlement and its prevention, softening of hard water, lime soda process, permutit process (zeolite process), Ion exchange process, reverse osmosis (R.O.) process, estimation of total hardness by EDTA method.</p>	18
	<p>(C) <b>Wave mechanics:</b> introduction, matter waves, the wave nature of the electron, wave equation, De-Broglie equation and Heisenberg's uncertainty principle, fundamental postulates of wave mechanics, introduction of Schrodinger's wave equation, quantum numbers, numericals based on De-Broglie equation and Heisenberg's uncertainty principle.</p>	



3	<p>(A) <b>Molecular weight determination of organic compounds:</b> concept of molecular weight, molecular weight determination of volatile organic compound by Victor-Mayer's method including its apparatus, experimental procedure and related calculations and sums. Molecular weight determination of carboxylic acids by silver salt method including its procedure, calculations and sums. Molecular weight determination of an organic base by Chloroplatinate method with its procedure, calculations and sums. Introduction of empirical formula and molecular formula with numericals.</p> <p>(B) <b>Photochemistry:</b> introduction of photochemistry, difference between thermal and photochemical process, laws of photochemistry, Grothus Draper's law and Stark-Einstein's law of photochemical equivalence, quantum yield, photochemical reaction of hydrogen with chlorine and bromine, qualitative description of fluorescence and phosphorescence, photosensitized reactions, energy transfer process.(simple, complex)</p>	17
4	<p>(C) <b>Reactions and mechanism:</b> introduction of reactions and mechanism, introduction to reagent and reactant, fission of covalent bond, nucleophilic reagent and electrophilic reagent, classification of organic reactions, study of substitution reaction, 12</p> <p>(D) addition reaction, elimination reaction, mechanism of SN and SN reactions, mechanism of E1 and E2 reactions, Mechanism of electrophilic aromatic substitution reactions e.g., nitration, sulphonation, halogenation, alkylation.</p> <p>(E) Synthesis and uses of some important compounds: sulphanilamide, p-amino salicylic acid, adrenaline, 8-hydroxy</p> <p>(F) quinoline, indigo, methyl orange, vanillin, paracetamol and aspirin.</p>	17

### : REFERENCE BOOKS:

1. Basic Inorganic chemistry, -F.A.Cotton, G.Wilkinson; John Wiley & Sons
2. Modern Inorganic chemistry, -G.D.Parkes; Longmans, Green & Co. London.
3. Modern Inorganic Chemistry, - R.D.Madan; S.Chand & Company Ltd.
4. Organic Chemistry vol-I, - I.L.Finar ; Longman Scientific & Technical Publication.
5. Organic Chemistry vol-II, - I.L.Finar ; Longman Scientific & Technical publication.
6. Reaction Mechanisam & Reagents in Organic Chem.- G.R.Chatwal; Himalaya Pub. house.
7. Organic reaction mechanism by Ahluwalia parasar.: Narosa Publishing House.
8. Text book of Physical Chemistry, - Glasstone ; London Macmillan & Company Ltd.
9. Physical Chemistry, - William F. Sheehan ; Prentice hall of India Pvt. Ltd.
10. Physical Chemistry, - Frank.H.Mac Dougall ; New York The Macmillan Company.
11. Industrial Chemistry, -Dr B.K.Sharma; Goel Publication house.
12. Roger's Industrial Chemistry, -C.C,Furnas; D.Van Nostrand compony, Inc.





**B.Sc. (CHEMISTRY)  
SEMESTER-I**

**Paper No: CHECC – 204**

**Title of the Paper: Practical [Based on paper CHECC -203]**

**Marks: Semester Terminal Examination: 100Marks Credits: 02**

**Detailed Curriculum for Practical**

*Students have to prepare their Practical journals of Chemistry for Laboratory work and they have to submit certified journals in the University practical exams. Students are not allowed in the laboratory without certified journals in the University practical examination.*

Detailed Syllabus for Chemistry Practical	Teaching Hours
<p><b>Inorganic Qualitative analysis of compounds having two radicals.</b> Positive radicals: <math>\text{Cu}^{+2}</math>, <math>\text{Sb}^{+2}</math>, <math>\text{Cd}^{+2}</math>, <math>\text{As}^{+3}</math>, <math>\text{Al}^{+3}</math>, <math>\text{Fe}^{+3}</math>, <math>\text{Fe}^{+2}</math>, <math>\text{Zn}^{+2}</math>, <math>\text{Mn}^{+2}</math>, <math>\text{Ni}^{+2}</math>, <math>\text{Co}^{+2}</math>, <math>\text{Ca}^{+2}</math>, <math>\text{Ba}^{+2}</math>, <math>\text{Sr}^{+2}</math>, <math>\text{Mg}^{+2}</math>, <math>\text{Na}^{+}</math>, <math>\text{K}^{+}</math>, <math>\text{NH}_4^{+}</math></p> <p>Negative radicals : <math>\text{CO}_3^{-2}</math>, <math>\text{O}^{-2}</math>, <math>\text{Cl}^{-1}</math>, <math>\text{Br}^{-1}</math>, <math>\text{I}^{-1}</math>, <math>\text{PO}_4^{-3}</math>, <math>\text{S}^{-2}</math>, <math>\text{SO}_3^{-2}</math>, <math>\text{NO}_2^{-1}</math>, <math>\text{NO}_3^{-1}</math>, <math>\text{CrO}_4^{-2}</math>, <math>\text{Cr}_2\text{O}_7^{-2}</math>, <math>\text{SO}_4^{-2}</math> (Minimum 16 compounds)</p> <p><b>Redox titration:</b> To determine the molarity and gm/lit of <math>\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}</math> and <math>\text{NaOH}</math> by using 0.02 M <math>\text{KMnO}_4</math> solution. To determine the molarity and gm/lit of each component in a mixture of <math>\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}</math> and <math>\text{H}_2\text{SO}_4</math> by using 0.02 M <math>\text{KMnO}_4</math> and 0.12 M <math>\text{NaOH}</math> solution. To determine the molarity and gm/lit of each component in a mixture of <math>\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}</math> and <math>\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}</math> by using 0.02 M <math>\text{KMnO}_4</math> and 0.08 M <math>\text{NaOH}</math> solution. To determine the molarity and gm/lit of <math>\text{FeSO}_4(\text{NH}_4)_2 \text{SO}_4 \cdot 6\text{H}_2\text{O}</math> and <math>\text{K}_2\text{Cr}_2\text{O}_7</math> solutions using 0.02 M <math>\text{KMnO}_4</math> solution by using diphenyl amine as an internal indicator.</p>	<b>60</b>

**: REFERENCE BOOKS :**

1. Vogel's Textbook of practical organic chemistry, 5th Edition by B. S. Furniss et.al.
2. Vogel qualitative Inorganic Analysis by G. Svehla.:universities press.
3. Organic qualitative analysis by Mann sunder.
4. Comprehensive practical organic chemistry, V. K. Ahuwalia.