GUJARAT UNIVERSITY
B. Sc. SEMESTER III
CHEMISTRY
ACCORDING TO NEP - 2020

Course Structure with respect to credit, hours and marks

Course Type	Course	Credit	Work Hours/ week	Exam hours	Marks		Total Mark
					Internal	External	
Multi-Disciplinary Courses (Inter Disciplinary)	MDC – CHE 234(T) Bonding and thermochemistry	2	2	2	25	25	50
	MDC – CHE 234P Chemistry practical	2	4	3	25	25	50

*** MDC – CHE 234P = CHEMISTRY PRACTICAL**

N.B.: Each practical batch should have 10 students

No. of students per batch during practical exam = 10

B. Sc. SEMESTER III
MDC – CHE 234T
BONDING AND THERMOCHEMISTRY

Learning Objectives:

- To study basic principles and application of valence bond theory and molecular orbital theory.
- To develop the basic knowledge and conceptual ideas regarding the formation of bonding and antibonding molecular orbitals.
- To understand energy level diagram of molecular orbitals.
- To understand the fundamental concepts of thermodynamics, Energy, work, and enthalpy.
- To study the zeroth and first law of thermodynamics and its application.
- To study the principles of inorganic qualitative analysis of inorganic mixtures.
- To know how to perform dry test and wet test for inorganic radicals.
- To understand the detection of positive and negative ions present in inorganic mixtures.

Learning outcomes:

By the end of the course, the students will be able to:

- Draw molecular orbital diagram of different molecules.
- Find bond order, bong length and bond strength of different molecules.
- Learn basic difference between bonding and antibonding molecular orbitals.
- Solve the problems of Heat, energy, work, enthalpy and bond energy.
- Derive different equations for zeroth and first law of thermodynamics.

- Know the preparation of water extract and original solution of inorganic mixture.
- Identify positive and negative ion present in the inorganic mixture.

B. Sc. SEMESTER – III
MDC – CHE 234(T+P)
BONDING AND THERMOCHEMISTRY

UNIT – I – Chemical Bonding **[25 Marks]**
[15 Hours]

Valence bond theory of bond formation and its limitations (Heitler and London approach), Formation of H_2 molecule by valence bond theory, Molecular orbital Theory, LCAO Method, conditions for the combination of atomic orbitals to form molecular orbitals, bonding and antibonding molecular orbitals, σ and π molecular orbitals, mixing of orbitals, energy level diagram for molecular orbitals, rules for filling up of molecular orbitals, Bond order and its calculation, stability of molecules in terms of bonding and antibonding electrons, relation between bond order, bond strength and bond energy, Molecular orbital diagrams of heteronuclear diatomic molecules (CO, NO, NO^+, CN^-, HF, HCl), Molecular orbital diagrams of heteronuclear polyatomic molecules (BeH_2, NH_3), Molecular orbital diagrams of $[CoF_6]^{-3}$ and $[Co(NH3)_6]^{+3}$, Band Theory for metals.

Unit – I: Thermodynamics **[25 Marks]**
[15 Hours]

Thermodynamics terms, Intensive and extensive properties, state and path functions, isolated, closed and open systems, zeroth law of thermodynamics.

First law: Concept of heat *q*, work *w*, internal energy U, and statement of first law, enthalpy H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Heats of reactions: standard states, enthalpy of formation of molecules and ions and enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

MDC – CHE 234P

CHEMISTRY LAB – V

[50 marks]
[60 Hours]

Inorganic qualitative analysis for inorganic Mixture

Semi micro method of analysis of inorganic mixture containing four radicals (excluding phosphate, arsenite, arsenate and borate, (Pb^{+2}, Hg^{+2}, Cd^{+2}, Cr^{+3} only demonstrated, do not given as practical)

A minimum of twelve mixtures should be performed.

Inorganic Preparations

(1) Tetrammine cupric sulphate $[Cu(NH_3)_4SO_4]$. H2O

(2) Ferrous ammonium sulphate (Mohr's salt) $FeSO_4(NH_4)_2SO_4$. $6H_2O$

(3) Hexa-ammine nickel(II) chloride $[Ni(NH_3)_6]$ Cl_2

(4) Potash Alum $K_2SO_4.Al_2(SO_4)_3$. $24H_2O$

(5) Sodium cobaltinitrite $Na_3[Co(NO_2)_6]$

Viva-Voce questions.

REFERENCE BOOKS

1. '**Vogel's Qualitative analysis' by G. Svehla,** Pearson Education Ltd., Seventh Edition,2009

2. '**Vogel's Textbook of Quantitative Chemical analysis'** Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney, ELBS (English Language Book

Society) Longman. 5th Ed., New York.

3. **'Analytical Chemistry'** by Dhruba Charan Dash, 2011, 2th Ed., PHI Learning Private Ltd, New Delhi.

4. **'Analytical Chemistry' by Gary D. Christian,** 1986**,** 4th Ed., John Wiley & Sons.

5. *'***Advanced Practical Inorganic Chemistry'** by Gurdeep Raj, 9th Ed., Goel Publishing House, Meerut.

6. **'Advanced University Practical Chemistry'** by P. C. Kamboj, Vishal Publishing Co., Jallandhar – Delhi.