B.Sc. III Semester-Chemistry

Course No: **DSC-2C** ***Max. Marks: 80***

Course Weightage: 04 Credits ***End Term Exam: 60***

No. of Contact Hours: 60 ***Continuous Assessment: 10***

Attendance: 10

Unit-I: p-Block Elements: **(16 Contact hours)**

Boranes**:** Nomenclature, Classification, Preparation, Properties, Structure and Bonding with special reference to Diborane.

Bonding in higher boranes: Types of bonds, Introductory concept about carboranes and metallocarboranes.

Nitrogen Compounds: Preparation, properties and uses of Hydrazine, Hydroxylamine .Oxides and Oxoacids of nitrogen;Structure and bonding..

Oxygen**:** Chemistry of different forms (atomic , molecular and ozone). Oxides, Fluorides and Oxyacids of Sulphur: Structure & Bonding. Hydrogen Peroxide: Preparation, Structure and Methods of purification.

Halogens: Comparative chemical reactivity, Types, Properties, Structure & Bonding of hydrogen halides, Interhalogens and Polyhalides. Oxyacids of Chlorine: Structure and Bonding.

Noble gases*:* Isolation and importance of noble gases in theoretical chemistry.

Fluorides, oxides and oxyfluorides of Xenon: Structure and bonding (VBT)

****

Unit-II Transition and Inner-Transition Elements: (14 Contact hours)

***Transition Elements*:** Variation in atomic and ionic sizes, Ionization enthalpies, Variable oxidation states. Standard electrode Potentials of M^{2+}/ M and M^{3+}/ M^{2+} systems.

Spectral and Magnetic Properties; Calculation and Uses of magnetic moment value.

Transition metal oxides: Ionic / Covalent character and Acidic / Basic character. Unusual oxidation states and their stabilization. Interstitial compounds of first transition series.

Inner-Transition Elements: Electronic Configuration, Oxidation States, Magnetic Properties and Complexing behavour of inner transition elements.

Lanthanoid / Actinoid Contraction: Cause and Consequences.

Separation of Lathanoids: Fractional Crystallization, Ion–exchange and Solvent extractionmethods.

****

Unit- III Chemical Thermodynamics: (18 Contact hours)

Thermodynamic functions: State and path functions and their differentials. Thermodynamic processes. Concept of heat and work. Heat capacity, heat

capacities at constant volume and constant pressure and their relationship.Joule's law, Joule-Thomson coefficient and inversion temperature.Calculation of ΔU & ΔH for the expansion of ideal and non-ideal (van der Waals) gases under isothermal and adiabatic conditions.

Second law of thermodynamics: Different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of entropy, entropy as a function of V & T, and as a function of P&T. Clausius inequality; entropy as criteria for spontaneity and equilibrium. Entropy change in physical processes, ideal gas expansion and entropy of mixing of ideal gases.

Third law of thermodynamics: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, Nernst heat theorem, third law of thermodynamics, concept of residual entropy, ΔG & ΔA as criteria for thermodynamic equilibrium and spontaneity. their advantage over entropy change. Variation of G and A with P, V and T, Gibbs-Helmholtz equation.

Nernst distribution law: Statement and thermodynamic derivation, applications.

Unit-IV Photochemistry: (12 Contact hours)

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Beer-Lambert Law, Laws of photochemistry. Grothus-Drapper law, Stark-Einstein law, Primary Photochemical process, Secondary Photochemical process. Quantum Yield, Reason for Low and High

Quantum Yield, Determination of Quantum Yield, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), Energy transfer processes; photosensitization and Quenching. Stern Volmer Equation.

Kinetics of photochemical reactions: Photochemical decomposition of hydrogen iodide. Hydrogen-chlorine and hydrogen-bromine reactions, Comparison with thermal decomposition reactions.

Books Recommended:

1. Basic Inorganic Chemistry; F.A. Cotton; G. Wilkinson & P.L. Gauss; 3rd ed.; Wiley; 2002.

2. Chemistry of Elements; Greenwood Earnshaw; 2nd ed.; Butterworth; 2000.

3. Advanced Inorganic Chemistry; Prakash, S.; Tuli, G.D.; Basu, S.K. & Madan, R.D.; Vol. 1.; S.Chand & Co.

4. Inorganic Chemistry; Miessler G.L.& Tarr, T.A.; 3rd ed.; Prentice Hall; 2009

5. Inorganic Chemistry; Shriver, D.E.; Atkins, P.W. & Langford, C.H.; 4th ed.; Oxford; 2006.

6. Concepts and Models of Inorganic Chemistry; Douglas, B.; Daniel, D. Mc. & Alexander, J.; 3rd ed.;Wiley; 2001.

7. Advanced Inorganic Chemistry; Prakash, S.; Tuli, G.D.; Basu, S.K. & Madan, R.D.; Vol. 1.; S.Chand & Co.

8. Principals of Physical Chemistry; Puri, Sharma and Pathania; S. Nagin Chand & Co; 2011.

9. The Elements of Physical Chemistry; Atkins, P. W.; Oxford University Press.

10. Physical Chemistry; Barrow, G. M.; 5th ed.; McGraw-Hill; International Student edition; 1992.

11. Physical Chemistry; Alberty, R. A.; Wiley Eastern Ltd.

12. Essentials of Physical Chemistry;; Kapoor, K. L.; Vols. III & IV; 2nd ed.; Macmillan India Ltd; 2005.

13. Physical Chemistry through Problems; Dogra, S. K.; Wiley Eastern Ltd; 1991.

14. University General Chemistry; Rao, C. N. R.; MacMillan.

Lab Course- Chemistry

B.Sc. Semester-III

Course No: **DSC-2C Lab.** ***Max. Marks: 20***

Course Weightage: 02 Credit ***End Term Exam: 15***

Attendance: 05

No. of Contact hours: 30

Section A: Inorganic Chemistry

(a) Qualitative Analysis: To identify the given Inorganic mixture containing three acidic and three basic radicals (excluding insoluble and interfering radicals) by Macro Scale Analysis (06 known and 06 unknown mixtures)

(b) Paper Chromatography: Separation and identification of metals from mixtures containing two cations (03 exercises)

Section B: Physical Chemistry

Thermochemistry:

1. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
2. Determination of enthalpy of ionization of acetic acid.
3. Determination enthalpy of hydration of copper sulphate.

Ionic equilibrium:

1. Preparation of buffer solutions of the following compositions:

   a) Sodium acetate- Acetic acid
   b) Ammonium chloride-Ammonium Hydroxide

2. Titration of a strong base with a strong acid using pH- meter

Books Recommended:

1. Vogel's; text book of Quantitative Inorganic Analysis (revised); Bassett, J.; Denney, R.C.; Jeffery,

G. H and Mendham, J.; 6th ed.; ELBS; 2007.

2. Experimental Inorganic Chemistry; Palmer, W.G.; Cambridge.

3. Analytical Chemistry; Christian, G. D.; 6th ed.; Wiley; 2008.

4. Practical Physical Chemistry; Khosla, B. D.; Garg, V. C. & Gulati, A.; R. Chand & Co.; 2011.

5. Selected Experiments in Physical Chemistry; Mukherjee N.G.& Ghosh, J.N.; S. Chand & Sons.

6. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.

7. Advanced Practical Physical Chemistry; Yadav, J.B.; 20th ed.; Goel Publishing House, 2001.