B.Sc (MINOR) SYLLABUS DISTRIBUTION 2023-24 (NEP 2020)

Chemistry MINOR

Paper code: CHEM102-I

Paper title: General Chemistry-I Credits 3+1

Theory Credits 3

Name of the Teacher: Dr. Pradipta Kumar Basu

4. Aliphatic hydrocarbons

Functional group approach for the following compounds to be studied in context of their preparations, properties, structures and reactions

Alkanes (up to 5 carbons): preparation- catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis using Grignard reagent; Reaction mechanism for free radical substitution, halogenation

Alkenes (up to 5 carbons): preparation- elimination reactions, dehydration of alcohols and dehydrohalogenation of alkyl halides, *cis* alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction), reactions- *cis*-addition (alkaline KMnO4) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction

Alkynes (up to 5 carbons):preparation- acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides, formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alkaline $KMnO_4$ *10 Hours*

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

Name of the Teacher: Dr. Debasish Kundu

1. Atomic structure

Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations *6 Hours*

2. Periodic properties

Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements, positions of hydrogen and noble gases, atomic and ionic radii, ionization potential, electron affinity and electronegativity,periodic and group-wise variation of above properties in respect of s- and p- block elements

6 Hours

3. Acids and bases

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents,Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept, hard and soft acids and bases (HSAB concept), applications of HSAB process, acidity and basicity of common organic compounds *7 Hours*

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

Name of the Teacher: Dr. Dinesh Maity

5. Ideal and real gases

Concept of pressure and temperature, Deviation of gases from ideal behaviour, compressibility factor, Boyle temperature, Andrew's and Amagat's plots, van der Waals equation and its features, derivation and application in explaining real gas behaviour, existence of critical state, critical constants in terms of van der Waals constants, law of corresponding states

Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only) *5 Hours*

6. Thermodynamics-I

Intensive and extensive properties state and path functions, isolated, closed and open systems, zeroth law of thermodynamics,concept of heat, work, internal energy 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

Standard states, heat of reaction, enthalpy of formation of molecules and ions, enthalpy of combustion and its applications, laws of thermochemistry, bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchoff's equation and effect of pressure on enthalpy, adiabatic flame temperature, explosion temperature

7 Hours

7. Chemical Kinetics-I

Introduction of rate law, order and molecularity, extent of reaction, rate constants, rates of first-, second- and n-th order reactions and their integrated forms (with derivation), pseudo first order reactions, determination of order of a reaction- half-life and differential method, opposing reactions, consecutive reactions and parallel reactions (elementary idea)

Theories of reaction rate: Temperature dependence on reaction rate, Arrhenius equation, energy of activation *4 Hours*

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

CHEMISTRY PRACTICAL:

Name of the Teacher: Dr. Debasish Kundu & Dr. Dinesh Maity

(i) Determination of boiling points

Boiling points of common organic liquid compounds e.g., ethanol, cyclohexane, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide,etc.

12 Hours

Name of the Teacher: Dr. Pradipta Kumar Basu & Dr. Dinesh Maity

(ii) Identification of a pure organic compound

Solid compounds: oxalic acid, succinic acid, resorcinol, urea, glucose, benzoic acid and salicylic acid.

Liquid Compounds: acetone, aniline and nitrobenzene *18 Hours*

(Dr. PRADIPTA KUMAR BASU)
Associate Professor & Head
Department of Chemistry

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

SEMESTER II SYLLABUS DISTRIBUTION 2023-24 (NEP 2020)

Chemistry MINOR

Paper code: CHEM202-I

Paper title: General Chemistry-II Credits 3+1

Theory Credits 3

Name of the Teacher: Dr. Pradipta Kumar Basu

4. Fundamentals of Organic Chemistry

Electronic displacement phenomena- inductive effect, resonance and hyperconjugation, cleavage of bonds- homolytic and heterolytic, structures of organic molecules on the basis of VBT, nucleophiles, electrophiles, reactive intermediates- carbocations, carbanions and free radicals.

6 Hours

6. Nucleophilic Substitution and Elimination Reactions

Nucleophilic substitutions- S_N1, S_N2 and S_Ni reactions, eliminations- E_1 and E_2 reactions (elementary mechanistic aspects), Saytzeff and Hofmann eliminations, elimination vs. substitution *6 Hours*

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

Name of the Teacher: Dr. Debasish Kundu

3. Chemical Kinetics-II

Collision theory, Lindemann theory of unimolecular reaction, outline of Transition State theory (classical treatment) *5 Hours*

---

7. Chemical Bonding and Molecular Structure

Ionic Bonding: general characteristics, energy considerations, lattice energy and solvation energy and their importance for stability and solubility of ionic compounds, statement of Born-Landé equation for lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability, Fajans' rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character

Covalent bonding: Valence Bond (VB) theory approach, shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements Concept of resonance and resonating structures in various inorganic and organic compounds Molecular orbital (MO) theory approach -the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including the idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+, comparison of VB and MO approaches *12 Hours*

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

Name of the Teacher: Dr. Dinesh Maity

1. **Thermodynamics-II**

Statement of the second law of thermodynamics, concept of heat reservoirs and heat engines, Carnot cycle, physical concept of entropy, Carnot engine, refrigerator and efficiency, entropy change of systems and surroundings for various processes and transformations, auxiliary state functions (G and A) and criteria for spontaneity and equilibrium

5 Hours

2. **Ideal gas**

Collision of gas molecules, collision diameter, collision number and mean free path, frequency of binary collisions (similar and different molecules), rate of effusion

Nature of distribution of velocities, Maxwell's distribution of speed and kinetic energy, average velocity, root mean square velocity and most probable velocity, equipartition principle and its application to calculate the classical limit of molar heat capacity of gases.

5 Hours

5. **Stereochemistry**

Isomerism- geometrical and optical isomerism, concept of chirality and optical activity (up to two carbon atoms), asymmetric carbon atom, elements of symmetry (plane and centre), interconversion of Fischer and Newman representations, enantiomerism and diastereomerism, meso compounds, threo and erythro, D and L, cis- and trans- nomenclatures, CIP rules: R/S (upto 2 chiral carbon atoms) and E/Z nomenclatures.

6 Hours

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

Reference Books:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.
4. Atkins, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.
6. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.
7. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.
8. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998).
9. Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood (1999).
10. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012.
11. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
12. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
13. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).
14. Morrison, R. T. Study guide to organic Chemistry, Pearson.
15. Pathak & Saha, Organic Chemistry (Volume-1), Books and Allied (P) Ltd.
16. Castellan, G. W. Physical Chemistry, Narosa Publishing House.
17. Engel, T. & Reid, P. Physical Chemistry, Pearson.
18. Maron, S. &Prutton, Principles of Physical Chemistry, Collier Macmillan Ltd.
19. Laidler, K. J. Chemical Kinetics, Pearson.
20. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry.
21. Rakshit, P.C., Physical Chemistry, Sarat Book House.
22. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas Publishing House.
23. Sharma, K. K. & Sharma, L. K., A Textbook of Physical Chemistry, Vikas Publishing House.
24. Bajpai, D. N., Advanced Physical Chemistry, S. Chand Publication.
25. Rajaram, J. Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson.
26. Nasipuri, D. Stereochemistry of Organic Compounds, New Age International (P) Ltd.
27. Sengupta,S.Basic Stereochemistry of Organic Molecules, Oxford University Press
28. Chatterjee Hrishikesh, Physical Chemistry (Volume-1), Platinum Publisher
29. Kapoor, K.L., Textbook of Physical Chemistry (Volume 1 and Volume-2), McGraw Hill Education
30. Ghoshal, A. Numerical problems & short questions on Physical Chemistry, Books and Allied (P) Ltd.
31. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press.

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132

CHEMISTRY PRACTICAL:

Name of the Teacher: Dr. Pradipta Kumar Basu, Dr. Debasish Kundu & Dr. Dinesh Maity

Practical Credit 1

1. Determination of pH of unknown strong alkali and acid by colour matching method
2. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate
3. Estimation of Mohr's salt by titrating with $KMnO_4$/ $K_2Cr_2O_7$
4. Estimation of sodium carbonate and sodium hydrogen carbonate in a mixture *30 Hours*

Reference Books:

1. Bhattacharyya, R. C, A Manual of Practical Chemistry.
2. Nad, Mahapatra, Ghosal, An Advance course in Practical Chemistry, New Central Book Agency (P) Ltd.
3. K. S. Mukherjee, Textbook on Practical Chemistry, New Central Book Agency (P) Ltd.
4. Ghosh, Das Sharma, Majumdar, Manna, Chemistry in Laboratory, santra Publication (P) Ltd.
5. Poddar and Ghosh, Degree Practical Chemistry, Book Syndicate (P) Ltd.

(Dr. PRADIPTA KUMAR BASU)
Associate Professor & Head
Department of Chemistry

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132