

MINOR COURSES

SEMESTER-I
MINOR COURSES

MN-CHE-1A(THEORY):- INTRODUCTORY CHEMISTRY

Credit: Theory-03, 45 Hours, Full Marks=75, Pass Marks= 30

Marks: 15 (5 Att. + 10 SIE: 1Hr) + 60 (ESE: 3Hrs) =75

Pass Marks: Th (SIE + ESE) = 30

Instruction to Question Setter for

Semester Internal Examination (SIE 10+5=15 marks):

There will be two group of questions.

The Semester Internal Examination shall have two components. (a) One Semester Internal Examination Written Test (SIE) of 10 Mark. Question No.1 will be very short answer type in Group A consisting of five questions of 1 mark each. Group B will contain descriptive type two questions of five marks each, out of which any one to answer. (b) Class Attendance Score (CAS) including the behaviour of the student towards teachers and other students of the College of 5 marks.

End Semester Examination (ESE 60 marks):

There will be two group of questions. Group A is compulsory which will contain three questions. Question No.1 will be very short answer type consisting of five questions of 1 mark each. Question No.2 & 3 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

Note: There may be subdivisions in the questions of group B.

Section A: Physical Chemistry

UNIT I: Chemical Energetics: (8 classes each of 60 minutes duration)

Review of thermodynamics and the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations. Calculation of bond energy, bond dissociation energy from thermochemical data. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

UNIT II: Chemical Kinetics: (7 classes each of 60 minutes duration)

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

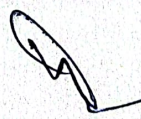
Section B: Inorganic Chemistry

UNIT III: Atomic Structure: (5 classes each of 60 minutes duration)

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrodinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

UNIT IV: Chemical Bonding and Molecular Structure: (10 classes each of 60 minutes duration)

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Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB 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.

Section C: Organic Chemistry

UNIT V: Fundamentals of Organic Chemistry: (3 classes each of 60 minutes duration)

Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Aromaticity: Benzenoids and Hückel's rule.

UNIT VI: Aliphatic hydrocarbons:

Alkanes: (4 classes each of 60 minutes duration) (Upto 5 Carbons)

Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent.

Reactions: Free radical Substitution: Halogenation

Alkenes: (3 classes each of 60 minutes duration) (Upto 5 Carbons)

Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule), Reactions: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and antiMarkownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (3 classes each of 60 minutes duration) (Upto 5 Carbons)

Preparation: Acetylene from CaC_2 and conversion into higher alkynes, by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

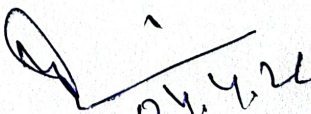
Reactions: Formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alkaline KMnO_4 .

UNIT VII: Aromatic hydrocarbons: (5 classes each of 60 minutes duration)

Preparation of benzene: from phenol, by decarboxylation, from acetylene, from benzene sulphonc acid. Reactions of benzene: Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene)

Reference Books:

1. J. C. Kotz, P. M. Treichel & J. R. Townsend: General Chemistry, Cengage Lening India Pvt. Ltd., New Delhi (2009)
2. Lee, J. D. Concise Inorganic Chemistry, Wiley, 5th Edn.
3. Douglas, B.E., McDaniel, D.H., Alexander J.J., Concepts & Models of Inorganic Chemistry, (Third Edition) John Wiley & Sons, 1999.
4. Atkins, P. W. and De Paula, J. Physical Chemistry, Tenth Edition, Oxford University Press, 2014.
5. Douglas, B.E, Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd Ed., John Wiley Sons, N.Y. 1994.
6. Peter Sykes, A Guide Book to Mechanism in Organic Chemistry, Longman.
7. C. K. Ingold, Structure and Mechanism in Organic Chemistry, Cornell University Press.
8. R. T. Morrison and R. N. Boyd, Organic Chemistry, Prentice-Hall.
9. H. O. House, Modern Organic Reactions, Benjamin.
10. O. C. Norman and J. M. Coxon, Principles of Organic Synthesis, Blackie Academic & Professional.
11. Ali, Hashmat, Reaction Mechanism in Organic Chemistry, S Chand


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MN-CHE-1A: MINOR PRACTICAL-1

Credit: Theory-01, 30 Hours, Full Marks=25, Pass Marks= 10

End Semester Examination (ESE):

There will be one Practical Examination of 3 Hours duration. Evaluation of Practical Examination may be as per the following guidelines:

One Experiment = 15 marks

Practical record notebook = 05 marks

Viva-voce = 05 marks

Section A: Physical

Thermochemistry

1. Determination of heat capacity of calorimeter.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of integral enthalpy of solution of salts (KNO_3 , NH_4Cl).
4. Determination of enthalpy of hydration of copper sulphate.

Section B: Inorganic Chemistry - Volumetric Analysis

1. Acid-Base Titrations

- a. Estimation of oxalic acid present in the supplied sample.
- b. Estimation of sodium hydroxide present in given sample.
- c. Estimation of amount of acetic acid in vinegar solution.
- d. Estimation of carbonate and hydroxide present together in mixture.
- e. Estimation of carbonate and bicarbonate present together in a mixture.
- f. Estimation of free alkali present in different soaps/detergents.

2. Oxidation-Reduction Titrimetry


- a. Estimation of Fe(II) in supplied solution using standardized KMnO_4 solution.
- b. Estimation of oxalic acid using standardized KMnO_4 solution.
- c. Estimation of percentage of Fe(II) in Iron fillings with standard $\text{K}_2\text{Cr}_2\text{O}_7$

Section C: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
 - a. Benzoylation of amines/phenols
 - b. Oxime and 2,4 dinitrophenyl hydrazone of aldehyde/ketone

Reference Books:

1. Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
2. F. G. Mann & B. C. Saunders, Practical Organic Chemistry, Orient Longman (1960).
3. B.D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co.
4. S. M. Khopkar, Environmental Pollution Analysis, Wiley Eastern Ltd, New Delhi.

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