Faculty of Engineering and Technology
Datta Meghe Institute of Higher Education and Research
(Deemed to be University)

NAAC Re-accredited Grade "A+"

Curriculum of General Aptitude
for AIPHDCET under DMIHER (DU)

Content:

Curriculum of **General Aptitude** for AIPHDCET, DMIHER (DU)

S. N.	Title
1	Verbal Aptitude**,** Quantitative Aptitude**,** Analytical Aptitude and Spatial Aptitude

Detailed Content

(Weightage = 15%)

Verbal Aptitude:

Basic English grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech Basic vocabulary: words, idioms, and phrases in context reading and comprehension narrative sequencing.

Quantitative Aptitude:

Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data) and 3-dimensional plots, maps, and tables.

Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series Mensuration and geometry Elementary statistics and probability.

Analytical Aptitude:

Logic: deduction and induction, Analogy, Numerical relations and reasoning.

Spatial Aptitude:

Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping paper folding, cutting, and patterns in 2 and 3 dimensions.

References:

1. Dr. R.S. Aggarwal, *A modern Approach to Logical Reasoning* S. Chand Publisher, 2018

2. P.N. Arora and S. Arora, *Quantitative Aptitude Mathematics*, S. Chand India Publication.

3. Dr. R.S. Aggarwal, *A modern Approach to Verbal and Nonverbal Reasoning* S. Chand Publisher, 2018

4. Abhijit Guha, *Quantitative Aptitude for All Competitive Examinations*, McGraw Hill Publication.

5. Dr. R.S. Aggarwal, *Quantitative Aptitude* S. Chand, 2013

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Curriculum of Chemistry for AIPHDCET under DMIHER (DU)

(Theme based)

Content:

Curriculum of **Chemistry** for AIPHDCET, DMIHER (DU)

Theme	Title
1	Structure, Equilibrium and Kinetics
2	Main Group, Transition Elements and Solids
3	Organic Synthesis, Reaction Mechanism and Stereochemistry
4	Spectroscopy and Instrumental Methods of Analysis
5	Pericyclic Reactions, Heterocyclic Compounds and Biomolecules

Detailed Content

Theme 1: Structure, Equilibrium and Kinetics (Weightage = 17 %)

1. Quantum theory: principles and techniques; applications to a particle in a box, harmonic oscillator, rigid rotor and hydrogen atom; valence bond and molecular orbital theories, Hückel approximation; approximate techniques: variation and perturbation; symmetry, point groups; rotational, vibrational, electronic, NMR, and ESR spectroscopy.
2. Kinetic theory of gases; First law of thermodynamics, heat, energy, and work; second law of thermodynamics and entropy; third law and absolute entropy; free energy; partial molar quantities; ideal and non-ideal solutions; phase transformation: phase rule and phase diagrams – one, two, and three component systems; activity, activity coefficient, fugacity, and fugacity coefficient; chemical equilibrium, response of chemical equilibrium to temperature and pressure; colligative properties; Debye-Hückel theory; thermodynamics of electrochemical cells; standard electrode potentials: applications – corrosion and energy conversion; molecular partition function (translational, rotational, vibrational, and electronic).
3. Rates of chemical reactions, temperature dependence of chemical reactions; elementary, consecutive, and parallel reactions; steady state approximation; theories of reaction rates – collision and transition state theory, relaxation kinetics, kinetics of photochemical reactions and free radical polymerization, homogeneous catalysis, adsorption isotherms and heterogeneous catalysis.

Theme 2: Main Group, Transition elements and Solids (Weightage = 17 %)

1. General Characteristics, allotropes, structure and reactions of simple and industrially important compounds: boranes, carboranes, silicones, silicates, boron nitride, borazines and phosphazenes. Hydrides, oxides and oxoacids of pnictogens (N, P), chalcogens (S, Se &Te) and halogens, xenon compounds, pseudo halogens and interhalogen compounds. Shapes of molecules and hard- soft acid base concept. Structure and Bonding (VBT) of B, Al, Si, N, P, S, Cl compounds. Allotropes of carbon: graphite, diamond, C60. Synthesis and reactivity of inorganic polymers of Si and P.

2. General characteristics of d and f block elements; coordination chemistry structure and isomerism, stability, theories of metal- ligand bonding (CFT and LFT), mechanisms of substitution and electron transfer reactions of coordination complexes. Electronic spectra and magnetic properties of transition metal complexes, lanthanides and actinides. Metal carbonyls, metal- metal bonds and metal atom clusters, metallocenes; transition metal complexes with bonds to hydrogen, alkyls, alkenes and arenes; metal carbenes; use of organometallic compounds as catalysts in organic synthesis. Bioinorganic chemistry of Na, K. Mg, Ca, Fe, Co, Zn, Cu and Mo.
3. Crystal systems and lattices, miller planes, crystal packing, crystal defects; Bragg's Law, ionic crystals, band theory, metals and semiconductors, Different structures of AX, AX2 , ABX3 compounds, spinels.

Theme 3: Organic synthesis, reaction mechanism and stereochemistry

(Weightage = 17 %)

1. Synthesis, reagents, reactions, mechanisms and selectivity involving the following- alkenes, alkynes, arenes, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Use of compounds of Mg, Li, Cu, B and Si in organic synthesis. Concepts in multistep synthesis- retrosynthetic analysis, disconnections, synthons, synthetic equivalents, reactivity umpolung, selectivity, protection and deprotection of functional groups.
2. Methods of determining reaction mechanisms. Nucleophilic and electrophilic substitutions and additions to multiple bonds. Elimination reactions. Reactive intermediates- carbocations, carbanions, carbenes, nitrenes, arynes, free radicals. Molecular rearrangements involving electron deficient atoms.
3. Chirality of organic molecules with or without chiral centres. Specification of configuration in compounds having one or more stereo genic centres. Enantiotopic and diastereotopic atoms, groups and faces. Stereo selective and stereospecific synthesis. Conformational analysis of acyclic and cyclic compounds. Geometrical isomerism. Configurational and conformational effects on reactivity and selectivity/specificity.

Theme 4: Spectroscopy and instrumental methods of analysis (Weightage = 17 %)

1. Principles and applications of UV-visible, IR, NMR and Mass spectrometry in the determination of structures of organic molecules.

2. Atomic absorption and emission spectroscopy including ICP-AES, UV- visible spectrophotometry, NMR, mass, Mossbauer spectroscopy (Fe and Sn), ESR spectroscopy, chromatography including GC and HPLC and electro-analytical methods (Coulometry, cyclic voltammetry, polarography – amperometry, and ion selective electrodes).

Theme 5: Pericyclic reactions, heterocyclic compounds and biomolecules

(Weightage = 17 %)

1. Electrocyclic, cycloaddition and sigmatropic reactions. Orbital correlation, FMO and PMO treatments.

   Basic principles. Photochemistry of alkenes, carbonyl compounds, and arenes. Photo-oxidation and photo-reduction. Di-π- methane rearrangement, Barton reaction.
2. Structure, preparation, properties and reactions of furan, pyrrole, thiophene, pyridine, indole and their derivatives.
3. Structure, properties and reactions of mono- and di-saccharides, physicochemical properties of amino acids, chemical synthesis of peptides, structural features of proteins, nucleic acids, steroids, terpenoids, carotenoids, and alkaloids.

References:

1. Physical Chemistry by K. J. Laidler and J. M. Meiser
2. Physical Chemistry by P.W. Atkins
3. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma, and M. S. Pathania
4. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson, and Paul L. Gaus
5. Concise Inorganic Chemistry by J. D Lee
6. Inorganic Chemistry – Principles of structure and reactivity by J.E. Huheey, E.A. Keiter, R.L. Keiter, U.k. Medhi
7. Organic Chemistry by Clayden, Greeves, Warren, and Bothers
8. A guidebook to Mechanism in Organic Chemistry by Peter Sykes
9. Molecular Spectroscopy by Banwell
10. Organic Chemistry by I. L. Finar
11. Organic Chemistry by R. T. Morrison and R. N. Boyd
12. Spectroscopy of Organic Compounds by P.S. Kalsi