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 Physics for AIPHDCET under DMIHER (DU)

(Theme based)

Content:

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

Theme	Title
1	Mathematical Physics and Electrodynamics
2	Classical and Quantum Mechanics
3	Solid State Physics & Electronics
4	Thermodynamics and Statistical Physics
5	Atomic, Molecular, Nuclear and Particle Physics

Theme 1: Mathematical Physics and Electrodynamics (Weightage 17 %)

Vector calculus: linear vector space: basis, orthogonality and completeness; matrices; similarity transformations, diagonalization, eigenvalues and eigenvectors; linear differential equations: second order linear differential equations and solutions involving special functions; complex analysis: Cauchy-Riemann conditions, Cauchy's theorem, singularities, residue theorem and applications; Laplace transform, Fourier analysis; elementary ideas about tensors: covariant and contravariant tensors.

Solutions of electrostatic and magnetostatic problems including boundary value problems; method of images; separation of variables; dielectrics and conductors; magnetic materials; multipole expansion; Maxwell's equations; scalar and vector potentials; Coulomb and Lorentz gauges; electromagnetic waves in free space, non-conducting and conducting media; reflection and transmission at normal and oblique incidences; polarization of electromagnetic waves; Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge.

Theme 2: Classical and Quantum Mechanics (Weightage 17 %)

Lagrangian formulation: D'Alembert's principle, Euler-Lagrange equation, Hamilton's principle, calculus of variations; symmetry and conservation laws; central force motion: Kepler problem and Rutherford scattering; small oscillations: coupled oscillations and normal modes; rigid body dynamics: interia tensor, orthogonal transformations, Euler angles, Torque free motion of a symmetric top; Hamiltonian and Hamilton's equations of motion; Liouville's theorem; canonical transformations: action-angle variables, Poisson brackets, Hamilton-Jacobi equation.
Special theory of relativity: Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Postulates of quantum mechanics; uncertainty principle; Schrodinger equation; Dirac Bra-Ket notation, linear vectors and operators in Hilbert space; one dimensional potentials: step potential, finite rectangular well, tunneling from a potential barrier, particle in a box, harmonic oscillator; two and three dimensional systems: concept of degeneracy; hydrogen atom; angular momentum and spin; addition of angular momenta; variational method and WKB approximation, time independent perturbation theory; elementary scattering theory,

Born approximation; symmetries in quantum mechanical systems.

Theme 3: Solid State Physics & Electronics (Weightage 17 %)

Elements of crystallography; diffraction methods for structure determination; bonding in solids; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids: nearly free electron and tight binding models; metals, semiconductors and insulators; conductivity, mobility and effective mass; Optical properties of solids; Kramer's-Kronig relation, intra- and inter-band transitions; dielectric properties of solid; dielectric function, polarizability, ferroelectricity; magnetic properties of solids; dia, para, ferro, antiferro and ferri-magnetism, domains and magnetic anisotropy; superconductivity: Type-I and Type II superconductors, Meissner effect, London equation, BCS Theory, flux quantization.

Semiconductors in equilibrium: electron and hole statistics in intrinsic and extrinsic semiconductors; metal-semiconductor junctions; Ohmic and rectifying contacts; PN diodes, bipolar junction transistors, field effect transistors; negative and positive feedback circuits; oscillators, operational amplifiers, active filters; basics of digital logic circuits, combinational and sequential circuits, flip-flops, timers, counters, registers, A/D and D/A conversion.

Theme 4: Thermodynamics and Statistical Physics (Weightage 17 %)

Laws of thermodynamics; macrostates and microstates; phase space; ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck's distribution law; Bose-Einstein condensation; first and second order phase transitions, phase equilibria, critical point.

Theme 5: Atomic, Molecular, Nuclear and Physics (Weightage 17 %)

Spectra of one-and many-electron atoms; spin-orbit interaction: LS and JJ couplings; fine and hyperfine structures; Zeeman and Stark effects; electric dipole transitions and selection rules; rotational and vibrational spectra of diatomic molecules; electronic transitions in diatomic molecules, Franck-Condon principle; Raman effect; EPR, NMR, ESR, X-ray spectra; lasers: Einstein coefficients, population inversion, two and three level systems.

Nuclear radii and charge distributions, nuclear binding energy, electric and magnetic moments; semi-empirical mass formula; nuclear models; liquid drop model, nuclear shell model; nuclear force and two nucleon problem; alpha decay, beta-decay, electromagnetic transitions in nuclei; Rutherford scattering, nuclear reactions, conservation laws; fission and fusion; particle accelerators and detectors; elementary particles; photons, baryons, mesons and leptons; quark model; conservation laws, isospin symmetry, charge conjugation, parity and time-reversal invariance.

References:

1. David J. Griffiths, *Introduction to Electrodynamics. Third Edition, Prentice Hall*-2005, P.1-596

2. Goldstein Herbert, *Classical Mechanics. Third Edition, Addison Wesley*-1980, P.1-646

3. David J. Griffiths, *Introduction to Quantum Mechanics. Second Edition, Pearson Education,* Inc.-2005, P.1-484.

4. RK Puri and VK Babbar, *Solid State Physics, S. Chad. Publisher*, New Delhi 2008.

5 Arthur Besier, *Fundamental of Physics with Applications*. *Fofth Edition, Tata McGraw-Hill*-2011.

6. Arthur Beiser, *Concept of Modern Physics. Sixth Edition, McGraw-Hill*-2003, P. 1-556.

7. F Rief. *Fundamental of statistical thermal physics, McGraw-Hill*, New York, 1965.

8. Raj Kumar, *Atomic and molecular spectra, Fifth edition*, 2019

8. K. Thyagarajan and Ajay Ghatak, Lasers: *Fundamentals and Applications, Laxmi Publications* - 2011