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

Content:

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

S. N.	Title
1	**Linear Algebra, Calculus, Differential equations, Analysis of complex variables, Probability and Statistics, Numerical Methods**

Engineering Mathematics (Weightage = 13%)

Linear Algebra: Matrix algebra, systems of linear equations, Eigenvalues and Eigenvectors.

Calculus: Mean value theorems, theorems of integral calculus, partial derivatives, maxima and Minima, multiple integrals, Fourier series, vector identities, line, surface and volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order linear and nonlinear differential equations, higher order linear differential equations with constant coefficients, method of separation of variables, Cauchy's and Euler's equations, initial and boundary value problems, and solution of partial differential equations.

Analysis of complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, residue theorem.

Probability and Statistics: Sampling theorems, conditional probability, mean, median, mode and standard deviation, random variables, discrete and continuous distributions: normal, Poisson and binomial distributions, Tests of Significance, statistical power analysis, and sample size estimation, Linear Regression and correlation analysis.

Numerical Methods: Matrix inversion, numerical solutions of nonlinear algebraic equations, iterative methods for solving differential equations, numerical integration.

References:

1.Dass, H. K. *Higher Engineering Mathematics*. S. Chand Publishing, 2011.

2. Grewal, B. S., and J. S. Grewal. *Higher engineering mathematics*." Khanna Publishers, New Delhi, 2002.

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

NAAC Re-accredited Grade "A+"

Curriculum of Mathematics for AIPHDCET under DMIHER (DU)

(Theme based)

Content:

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

Theme	Title
1	Analysis, Linear Algebra
2	Complex Analysis, Algebra
3	Ordinary Differential Equations (ODEs), Partial Differential Equations (PDEs)
4	Numerical Analysis, Calculus of Variations, Linear Integral Equations, Classical Mechanics
5	Descriptive Statistics, Exploratory Data Analysis

Detailed Content

Theme 1: Analysis and Linear Algebra (Weightage = 15 %)

Analysis Elementary set theory, finite, countable, and uncountable sets, Real number system, Archimedean property, supremum, infimum. Sequence and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals.

Linear Algebra Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformation. Algebra of matrices, rank, and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction, and classification of quadratic forms

Theme 2: Complex Analysis and Algebra (Weightage = 15 %)

Complex Analysis Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric, and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, and Open mapping theorem. Taylor series, Laurent series, calculus of residues.

Algebra Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, and Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness, and compactness.

Theme 3: Ordinary Differential Equations (ODEs), Partial Differential Equations (PDEs) (Weightage = 14%)

Ordinary Differential Equations (ODEs) Existence and uniqueness of solutions of initial value problems for first-order ordinary differential equations, singular solutions of first-order ODEs, and the system of first-order ODEs.

A general theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs) Lagrange and Charpit methods for solving first-order PDEs, Cauchy problem for first-order PDEs.

Classification of second-order PDEs, General solution of higher-order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat, and Wave equations.

Theme 4: Numerical Analysis, **Calculus of Variations**, **Linear Integral Equations**, **Classical Mechanics** (Weightage = 14%)

Numerical Analysis Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite, and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Calculus of Variations Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema.

Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and Eigen functions, resolvent kernel.

Classical Mechanics Generalized coordinates Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and the principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

Theme 5: Descriptive Statistics, Exploratory Data Analysis (Weightage =14 %)

Markov chains with finite and countable state space, classification of states, limiting behavior of n-step transition probabilities, stationary distribution, Poisson, and birth-and-death processes.

Standard discrete and continuous univariate distributions. Sampling distributions, standard errors and asymptotic distributions, distribution of order statistics, and range.

Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation, and test for independence, Elementary Bayesian inference.

Simple random sampling, stratified sampling, and systematic sampling. Probability is proportional to size sampling. Ratio and regression methods.

Hazard function and failure rates, censoring and life testing, series and parallel systems.

References:

1. Gupta, S. L., Gupta, N. R., *Principle of Mathematical Analysis.* Pearson Publication, 2003.
2. Bartle, R. G., *Real Analysis*. Wiley Publication, 2011.
3. Raisinghania, M. D., *Real Analysis*. S. Chand Publication 2020.
4. Lipson, M. C., Lipschutz, Lipson M., *Schaum's Outline of Linear Algebra.* McGraw Hill 2012.
5. Ponnusamy, S., *Foundations of Complex Analysis*, Narosa Publication, 2005.
6. Gallian, J. A., Contemporary Abstract Algebra, Narosa Publication, 2012.
7. Raisighania, M. D., *Ordinary Differential Equations*, S. Chand Publication 2020.
8. Jain, R. K., Iyenger, S. R. K., *Numerical Methods,* New Age International Private Limited, 2020.
9. Gupta, A. S., *Calculus of Variations with Applications,* Prentice Hall India Learning Private Limited, 1996.
10. Raisighania, M. D., *Integral Equations and Boundary Value Problems,* S. Chand Publication 2016.
11. Upadhyaya, J. C., *Classical Mechanics*, Himalaya Publication, 2019.
12. Gupta, S. C., Kapoor, V. K., *Fundamental of Mathematical Statistics*, S. Chand Publication, New Delhi, 2002.
13. Gupta, P. K., Hira, D. S., *Operations Research*, S. Chand Publication, New Delhi, 1992.
14. Deep, K., Mohan, C., *Optimization Techniques*, New Age Science Ltd, 2009.