

**Syllabus for General Aptitude (GA)***(COMMON TO ALL PAPERS)*

**Verbal Ability:** English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

**Numerical Ability:** Numerical computation, numerical estimation, numerical reasoning and data interpretation.

**Sample Questions****Verbal Ability**

**Q.1.** Choose the appropriate answer to complete the following sentence:

To those of us who had always thought him timid, his ----- came as a surprise.

(A) intrepidity (B) inevitability (C) inability (D) inertness

**Ans. (A)**

**Q.2.** Choose the appropriate answer to complete the following sentence:

Medicine is to illness as law is to \_\_\_\_\_

(A) discipline (B) anarchy (C) treason (D) etiquette

**Ans. (B)**

**Q.3.** Read the following paragraph :

“The ordinary form of mercury thermometer is used for temperature ranging from –40

o

F to

500

o

F. For measuring temperature below –40

o

F, thermometers filled with alcohol are used.

These are, however, not satisfactory for use in high temperatures. When a mercury thermometer is used for temperature above 500

o

F, the space above the mercury is filled with some inert gas, usually nitrogen or carbon dioxide, placed in the thermometer under pressure. As the mercury rises, the gas pressure is increased, so that it is possible to use these thermometers for temperatures as high as 1000

o

F.”

With what, besides mercury, would a thermometer be filled if it was designed to be used for measuring temperature of about 500

o

F?

(A) Pyrometer (B) Inert gas (C) Iron and brass (D) Gas

**Ans. (B)**

**Q.4.** The cost of manufacturing tractors in Korea is twenty percent less than the cost of manufacturing tractors in Germany. Even after transportation fees and import taxes are added, it is still cheaper to import tractors from Korea to Germany than to produce tractors in Germany. Which of the following assertions is best supported by the above information?

(A) Labour costs in Korea are twenty percent below those in Germany.

(B) Importing tractors into Germany will eliminate twenty percent of the manufacturing jobs in Germany.

(C) The costs of transporting a tractor from Korea to Germany is more than twenty percent of the cost of manufacturing the tractor in Korea.

(D) The import taxes on a tractor imported from Korea to Germany is less than twenty percent of the cost of manufacturing the tractor in Germany.

**Ans. (D)**

**Numerical Ability**

**Q.5.** In a survey,  $\frac{3}{16}$  of the people surveyed told that they preferred to use public transport while commuting daily to office.  $\frac{5}{8}$  of the people surveyed told that they preferred to use their own vehicles. The remaining 75 respondents said that they had no clear preference. How many people preferred to use public transport?

(A) 75 (B) 100 (C) 125 (D) 133

**Ans. (A)**

## **MA Mathematics**

### **Section 1: Linear Algebra**

Finite dimensional vector spaces; Linear transformations and their matrix representations, rank; systems of linear equations, eigenvalues and eigenvectors, minimal polynomial, Cayley-Hamilton Theorem, diagonalization, Jordan-canonical form, Hermitian, Skew-Hermitian and unitary matrices; Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, self-adjoint operators, definite forms.

### **Section 2: Complex Analysis**

Analytic functions, conformal mappings, bilinear transformations; complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle; Zeros and singularities; Taylor and Laurent's series; residue theorem and applications for evaluating real integrals.

### **Section 3: Real Analysis**

Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima; Riemann integration, multiple integrals, line, surface and volume integrals, theorems of Green, Stokes and Gauss; metric spaces, compactness, completeness, Weierstrass approximation theorem; Lebesgue measure, measurable functions; Lebesgue integral, Fatou's lemma, dominated convergence theorem.

### **Section 4: Ordinary Differential Equations**

First order ordinary differential equations, existence and uniqueness theorems for initial value problems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, series solutions (power series, Frobenius method); Legendre and Bessel functions and their orthogonal properties.

### **Section 5: Algebra**

Groups, subgroups, normal subgroups, quotient groups and homomorphism theorems, automorphisms; cyclic groups and permutation groups, Sylow's theorems and their applications; Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domains, Principal ideal domains, Euclidean domains, polynomial rings and irreducibility criteria; Fields, finite fields, field extensions.

### **Section 6: Functional Analysis**

Normed linear spaces, Banach spaces, Hahn-Banach extension theorem, open mapping and closed graph theorems, principle of uniform boundedness; Inner-product spaces, Hilbert spaces, orthonormal bases, Riesz representation theorem, bounded linear operators.

### **Section 7: Numerical Analysis**

Numerical solution of algebraic and transcendental equations: bisection, secant method, Newton-Raphson method, fixed point iteration; interpolation: error of polynomial interpolation, Lagrange, Newton interpolations; numerical differentiation; numerical integration: Trapezoidal and Simpson rules; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods

(Jacobi and Gauss-Seidel); numerical solution of ordinary differential equations: initial value problems: Euler's method, Runge-Kutta methods of order 2.

### **Section 8: Partial Differential Equations**

Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification; Cauchy, Dirichlet and Neumann problems; solutions of Laplace, wave in two dimensional Cartesian coordinates, Interior and exterior Dirichlet problems in polar coordinates; Separation of variables method for solving wave and diffusion equations in one space variable; Fourier series and Fourier transform and Laplace transform methods of solutions for the above equations.

### **Section 9: Topology**

Basic concepts of topology, bases, subbases, subspace topology, order topology, product topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma.

### **Section 10: Probability and Statistics**

Probability space, conditional probability, Bayes theorem, independence, Random variables, joint and conditional distributions, standard probability distributions and their properties (Discrete uniform, Binomial, Poisson, Geometric, Negative binomial, Normal, Exponential, Gamma, Continuous uniform, Bivariate normal, Multinomial), expectation, conditional expectation, moments; Weak and strong law of large numbers, central limit theorem; Sampling distributions, UMVU estimators, maximum likelihood estimators; Interval estimation; Testing of hypotheses, standard parametric tests based on normal,  $t$ ,  $F$ , distributions; Simple linear regression.

### **Section 11: Linear programming**

Linear programming problem and its formulation, convex sets and their properties, graphical method, basic feasible solution, simplex method, big-M and two phase methods; infeasible and unbounded LPP's, alternate optima; Dual problem and duality theorems, dual simplex method and its application in post optimality analysis; Balanced and unbalanced transportation problems, Vogel's approximation method for solving transportation problems; Hungarian method for solving assignment problems.