Contents

Preface vii

Syllabus ix

Vector Calculus and Vector Integration 1.1–1.84

Introduction — Parametric Representation of Curves — Derivative of a Vector Function — Derivatives of Sums and Products of Vectors — Derivative of a Scalar Product — Geometric Interpretation of $r'(t)$ — Integrals of Vector Functions — Motion of a Body or Particle on a Curve — The Vector Differential Operator Del — Gradient of a Scalar Field — Geometrical Interpretation of Gradient — Directional Derivative — Properties of Gradient — Divergence and Curl of a Vector Field — Physical Interpretation of Divergence — Physical Interpretation of Curl — Vector Identities — Line Integrals — Applications of Line Integrals — Line Integrals Independent of the Path — Green's Theorem in the Plane (Transformation between double integrals and line integrals) — Surface Integrals — Divergence Theorem of Gauss (Transformation between Volume Integrals and Surface Integrals) — Green's Identities (Formulas) — Stokes's Theorem (Transformation between surface integrals and line integrals).

Partial Differential Equations 2.1–2.42

Introduction — Formation of Partial Differential Equations — Equations Solvable by Direct Integration — Linear Partial Differential Equations of the First Order — Non-linear Equations of the First Order — Charpit's Method — Linear Homogeneous Equations with Constant Coefficients — Rules for Finding the Complementary Function (C.F.) — Rule to write the Complementary Function — Particular Integral (P.I.) (Special Methods) — General Method for Finding P.I. — Non-homogeneous Linear Equations with Constant Coefficients — Non-linear Differential Equations of the Second Order.

Applications of Partial Differential Equations 3.1–3.38

Introduction — Initial and Boundary Conditions — Method of Separation of Variables (Product Method) — Classification of Linear Second Order Partial Differential Equations — Equation of Vibrating String — Boundary Conditions — One-Dimensional Heat Flow: $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ — Two Dimensional Heat Flow, $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = a^2 \frac{\partial u}{\partial t}$ — Solution of Transmission Line Equations Problems by the Method of Separation of Variables.

4 Complex Analysis and Complex Integration 4.1–4.126

Introduction — **Functions of a Complex Variable: Analytic Functions** — Limits — Continuity of a function —Complex Differentiation — Analytic Functions — Polar form of Cauchy-Riemann Equations —Derivative of $w = f(z) = u + iv$ in Polar Form — Properties of Analytic Functions — Method of Construction of the Conjugate Function — Complex Potential Function — **Integration of Complex Functions** — Contour Integrals (Line Integrals in the Complex Plane) — Cauchy's Integral Theorem — Simple Closed Curve, Simply and Multiply Connected Domain — Cauchy's-Goursat Theorem — Cauchy's Integral Formula — Cauchy's Integral Formula for Derivatives — Morera's Theorem — Cauchy's Inequality — **Power Series, Taylor and Laurent Series** — Power Series —Taylor Series — Taylor's Theorem — Laurent Series — **Zeros, Singularities and Residues** —Introduction — Zeros and Singularities of Complex Functions — Evaluation of Contour Integrals Using Residues — Residue Theorem — Evaluation of Real Integrals Using Residues — **Bilinear Transformations and Conformal Mapping** — Introduction — Inverse Transformation — Bilinear Transformation — Conformal Mapping.

5 Numerical Methods 5.1–5.94

Introduction — Differences; Forward Differences, Backward Differences, Central Differences, — Difference Operators, $\Delta, \nabla, \delta, E, \mu$ — Relations between the Operators — Factorial Polynomial; Methods of Expressing an Algebraic Polynomial in Factorial Notation — Newton's Formulae For Interpolation; Newton's Forward and Backward Differences Formula for equal Intervals —Central Difference Interpolation Formulae; Gauss's Forward Formula, Gauss's Backward Formula, Stirling Formula, Bessel's Formula, Choice of Application of an Interpolation Formula — Interpolation with Unevenly Spaced Points; Lagrange's Interpolation Formula, Divided Differences, Newton's Formula for Divided Differences — Inverse Interpolation; Lagrange's Method, Method of Successive Approximations or the Method of Iteration, By Reversion of Series — Error in Newton's Interpolation Formulae — Numerical Differentiation — Introduction — Derivative using Newton's Forward and Backward Difference Formula — Derivative using Central Differences — Stirling's Formula — Maximum and Minimum value of a Tabulated Function — Numerical Integration, Introduction — Newton-Cotes quadrature or integration formula; Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8th Rule, Weddle's Rule — Errors in Computation.

6 Statistical Methods 6.1–6.75

Introduction — Frequency Distribution — Graphical Representation of a Frequency Distribution — Frequency Curve — Measures of Central Tendency — Arithmetic mean (AM) — Short methods for Computing the Arithmetic Mean — Two Important Properties of Arithmetic Mean — Median (Med.) — Mode — Empirical Relation Between Mean, Median and Mode — The Geometric Mean (G.M.) and Harmonic Mean (H.M.) — Relation Between Arithmetic, Geometric and Harmonic Means — Partition Values — Quartiles, Deciles and Percentiles — Dispersion of Variation — Range — Quartile Deviation or Semi-inter-quartile Range — Mean Deviation — Variance and Standard Deviation — Variance of the Combined Series — Relation Between Quartile Deviation, Mean Deviation and Standard Deviation — Coefficient of Variation (C.V.) — Moments—Introduction — Moments about an Arbitrary Point 'a' — Moments about the Mean — Relation Between the Moments about the Mean and Moments about any Point — Relation Between μ_r and μ'_r — Karl Pearson's Beta (β) and Gamma (γ) Coefficients based on Moments — Skewness

— Measures of Skewness — Kurtosis — Measure of Kurtosis — Curve Fitting — The Lines of Best Fit — Correlation — Scatter Diagram or Dot Diagram — Karl Pearson's (Product Moment) of Correlation Coefficient — Short-Computational Formulae — Correlation Table — Rank Correlation — Spearman's Modified Formula for Tied Ranks — Lines of Regression — Correlation and Regression.

Theory of Probability and Random Variables 7.1–7.70

Introduction — Random Experiments and Events — Definition of Probability — Theorems on Probability — Conditional Probability — Independent Events — Theorem of Total Probability — Inverse Probability—Baye's Theorem — Random Variables; Discrete Random Variable, Distribution Function, Continuous Random Variables and Distributions, Cumulative Distribution Function (cdf) — Theoretical Probability Distributions, Binomial Distribution, Poisson Distribution, Normal Distribution — Some Other Distributions, Uniform (or Rectangular) Distribution, Exponential Distribution, Beta Distribution.

Appendices A.1–A.15

Appendix-1 Some Constants, Some Important Conversion Factors, Greek Alphabet

Appendix-2 Mathematical Formulas

Appendix-3 Some Derivative and Integral Formulas

Appendix-4 Table I: Normal Distribution

Table II: Values of e^{-m}

Appendix-5 Solved Examination Paper AMIETE (New scheme) June 2013