

Contents

Preface — V

Part I

- 1 **Complex numbers and their properties — 3**
- 2 **Functions of complex variable — 19**
- 3 **Analytic functions (differentiability) — 34**
- 4 **Integration of functions of complex variable (curve integration) — 50**
- 5 **Cauchy theorem and Cauchy integral formulae — 57**

Exercises — 73

Part II

- 6 **Fundamental theorem of integration — 79**
- 7 **Harmonic functions and mean value formulae — 83**
- 8 **Liouville's theorem and the fundamental theorem of algebra — 98**
- 9 **Representation of analytic functions via the power series — 101**
- 10 **Laurent's expansions — 117**
- 11 **Residues and their calculus — 135**
- 12 **The principle of the argument and Rouché's theorem — 144**
- 13 **Calculation of integrals by residue theory — 149**
 - 13.1 Trigonometric integrals — **149**
 - 13.2 Improper integrals of the form $\int_{-\infty}^{\infty} f(x)dx$ — **153**
 - 13.3 Improper integrals of the form $\int_{-\infty}^{\infty} e^{iax} f(x)dx$ — **156**
 - 13.4 Improper integrals for multivalued functions — **163**

14 Calculation of series by residue theory — 170

15 Entire functions — 175

Exercises — 193

Part III

16 Conformal mappings — 199

17 Laplace transform — 220

18 Special functions — 247

18.1 Method of Frobenius — 247

18.2 Bessel functions — 252

18.3 Elliptic functions — 273

18.4 Orthogonal polynomials — 300

18.5 Laplace's method — 331

Exercises — 340

Bibliography — 349

Index — 351