UNIT 3 SPECIALIST MATHEMATICS

BOOK 1

Complex Numbers
The Imaginary Number
Operations Involving Imaginary Numbers

Properties of Complex Numbers
Equality
Addition and Subtraction
Multiplication
Complex Conjugates
Magnitude
The Multiplicative Inverse
Division of Complex Numbers

The Complex Number Plane
Geometrical Interpretation of Subtraction
Polar Form
Converting Cartesian Forms into Polar Form
Converting the Polar Form into Cartesian Form
Multiplication and Division in Polar Form
Geometrical Interpretation of Multiplication and Division

De Moivre's Theorem
Solving Equations in the Form $z^n=a$ Using De Moivre's Theorem
Finding nth Roots of a Complex Number
The nth Roots of Unity
Finding Square Roots in Exact Cartesian Form

Polynomials Over C
The Fundamental Theorem of Algebra
The Factor Theorem
The Conjugate Root Theorem

Factors Over C of Polynomials
Factorising Quadratics Over C
Factorising Cubics Over C
Factorising Polynomials of Degree Greater Than 3 Over C

Solution Over C of Polynomial Equations

Relations and Regions in the Complex Plane

Relations in the Complex Plane
Restrictions on Magnitude
Solving Questions Involving Restrictions on Magnitude
Rays and Lines
Common Types of Relations – Summary

Regions in the Complex Plane
Common Types of Regions – Summary

BOOK 2 – VECTORS

Vectors
Vector Notation
The Negative Vector
Position Vectors
Equality of Vectors
Addition of Vectors
The Identity Vector
Subtraction of Vectors
Multiplication of a Vector by a Scalar
Unit Vectors (Definition)
Vectors in 3-Dimensional Space
The Magnitude (Size) of a Vector
The Magnitude (Size) of Vectors Multiplied by Scalars

Vector Algebra in Component Form
Vector Equivalence

The Distance Between Two Vectors

Unit Vectors
Creating Unit Vectors

Direction Cosines

The Scalar Product of Two Vectors
Properties of the Scalar Product
The Angle Between Vectors vs The Dot Product
The Scalar Product of Vectors in Component Form
Angles Between Vectors

Resolving Vectors
Linear Projections
Identifying Projections
The Scalar Resolute/Projection
Perpendicular Scalar Resolutes
Vector Resolutes
Perpendicular Vector Resolutes

Linear Dependence and Independence

Vector Proofs
A General Approach to Vector Proofs
Proofs Involving Circles
Proofs Involving Lines
Proofs Involving Pyramids
Proofs Involving Quadrilaterals
Proofs Involving Parallelograms
Proofs Involving Trapezia
Proofs Involving Triangles

BOOK 3 – CALCULUS I

Differential Calculus
Formula List
The Derivative of tan(kx) and cot(kx)
The Second Derivative
Applications of the Second Derivative
Implicit Differentiation
Derivatives of Inverse Circular Functions

Integral Calculus – Techniques in Anti-Differentiation
Definition
Basic Properties
Standard Anti-Derivatives
Linear Substitution
The 'Reverse Chain Rule'
Anti-Derivatives of $\frac{1}{\sqrt{a^2-x^2}}$ and $\frac{1}{a^2+x^2}$

Anti-Derivatives of $\sin^2(kx)$ and $\cos^2(kx)$

Anti-Derivatives of odd powers of $\sin(kx)$ and $\cos(kx)$

Anti-Derivatives of $\tan^n(kx)$ and $\cot^m(kx)$

Anti-Derivatives of Expressions of the Form $\sin^m(kx)\cos^n(kx)$

Partial Fraction Decomposition
Rational Functions
N(x) = Polynomial of Degree 2 or Higher
Anti-Derivatives of Rational Functions with Quadratic Denominators
Anti-Differentiation by Recognition
The Relationship between the Graph of a Function and the Graph of its Anti-Derivative

Integral Calculus – Applications in Integration
Definite Integrals
Basic Properties
The Area Under a Curve
The Area Between a Curve and the Y Axis
The Area Between Two Curves
Volumes of Solids of Revolution
The Volume Between Two Curves

Lengths of Curves in the Plane

The Length of a Parametric Curve

BOOK 4

Area of Study 1: Functions and Graphs

Section 1: Rational Power Functions of Low Degree
Asymptotes
Sketching Rational Functions
- Graphs of Power Functions
- Graphing Rational Functions Using the Addition of Ordinates
- Graphing Rational Functions Using Multiplication of Ordinates
- Graphing Rational Functions Using the Key Features on a Graph
- Graphing Rational Functions Using the Reciprocal Theory

Section 2: Conics

Section 3: The Absolute Value (Modulus) Function

Section 4: Circular (Trigonometric) Functions