

CONTENTS

Preface v

1 1

The nature of vectors and scalars – Representation of a vector – Vector addition – Null vector and the use of the minus sign – Equal vectors – Subtraction of vectors – Unit vector – The parallelogram law of vector addition – Addition of several vectors – Multiplication of a vector by a scalar – Laws of vector algebra – Examples and exercises

2 13

Specification of vectors in components – Scalar multiplication, addition and subtraction of vectors, in terms of vector components – Examples and exercises – The Cartesian system of reference directions in three dimensions – The Cartesian system in two dimensions – Magnitude of a vector in the Cartesian system – Direction cosines – Scalar multiplication of a vector, addition and subtraction of vectors, in terms of Cartesian components – Examples and exercises

3 30

Relative vectors – Position vector of a point to divide a length in a given ratio – Centroid, centre of mass, centre of gravity – Examples and exercises

4 42

Vector equation of a straight line – Position vector of a point on a circle – Position vector of a point on a helix – Position vector of any point on a parabola – Position vector of any point on the ellipse – Position vector of any point on the hyperbola – Position vector of any point on the rectangular hyperbola – Position vector of any point on a plane – Examples and exercises

5	57
<i>Worked examples on quadrilateral, parallelogram, rhombus, triangle, tetrahedron; relative velocity, impulse, impact, closest approach of moving objects – Harder questions on Chapters 1–5</i>	
6	97
<i>Scalar product of vectors – Properties of the scalar product – Special cases of the scalar product – Work and scalar product – Vector equation of a plane using scalar product – Distance from a point to a plane using scalar product – Angle between two planes by scalar product – Shortest distance between two lines by scalar product – Examples and exercises</i>	
7	113
<i>Differentiation and integration of a vector with respect to a scalar – Radial and transverse components of velocity and acceleration – Tangential and normal components of velocity and acceleration – Examples and exercises – Harder questions on Chapters 6 and 7</i>	
8	133
<i>Vector product – Properties of the vector product – Some applications of the vector product – Proof of the distributive law – Cartesian forms – Vector triple product – The moment of a force – Couples as vectors – Moment of a force about a line – Examples and exercises</i>	
Answers to the exercises	146
Index	152