

# CONTENTS

<i>Preface</i>	ix
<b>1 Microscope alignment</b>	1
Basic geometrical optics	1
Köhler illumination	4
Alignment procedure	6
Looking after the microscope	7
Questions	8
<b>2 Properties of light</b>	9
Basic principles – why bother to learn them?	9
Properties of waves	10
Wave interference	13
Questions	16
<b>3 The limits of resolution</b>	18
The Rayleigh criterion	21
Limits to magnification	22
Comparisons with electron microscopy	23
Questions	23
<b>4 The Abbe approach</b>	24
Fourier analysis	24
The resolution limit	27
Optical and X-ray diffraction	29
Questions	31
<b>5 Bright-field, phase and dark-field microscopy</b>	32
Phase contrast	33
Alignment of the phase microscope	36
Dark-field microscopy	37
Questions	38

<b>6 Fluorescence microscopy</b>	40
The nature of fluorescence	40
Types of wavelength filter	41
Optical systems for observing fluorescence	42
Immunofluorescence	43
Other techniques	44
Questions	45
<b>7 Polarizing microscopy</b>	46
The production of polarized light	46
Birefringence	48
The measurement of birefringence	50
Questions	53
<b>8 Interference methods</b>	54
Interference contrast	54
The interferometer microscope	56
The measurement of mass or thickness	59
Interference reflection microscopy	60
Total internal reflection microscopy	61
Questions	61
<b>9 Aberrations and microscope design</b>	63
Chromatic aberration	63
Spherical aberration	64
Other aberrations	65
Objective testing	66
Microscope component markings	67
Questions	69
<b>10 Photomicrography</b>	70
Focusing the image	70
Choice of film and exposure time	71
Factors affecting image quality	72
<b>11 Summary, class experiments and further reading</b>	73
Class experiments	74
Further reading	77
<i>Appendix: Mathematical treatments</i>	78
<i>Answers to questions</i>	83
<i>Index</i>	87