

Contents

1	Introduction	1
1.1	Optical methods for Measurement and Testing	2
1.2	Aim of the present work	4
1.3	Synopsis of the present work	5
2	New Optical Techniques For Measurement	9
2.1	Diffusion Studies of Transparent Liquid Solutions	9
2.1.1	Importance of diffusion	10
2.1.2	Optical methods for determination of diffusivity	12
2.1.3	Chemical System Investigated	13
2.1.4	Preparation of Solution	13
2.1.5	Experimental Cell	14
2.1.6	Cell Filling Procedure	14
2.1.7	Theory of diffusion	15
2.1.8	Diffusion Studies Using Michelson Interferometer	19
2.1.9	Diffusion Studies Using Multiple Beam Interferometer	23
2.1.10	Diffusion Studies Using White Light and artificially generated fringes	26
2.1.11	Conclusion	34
2.2	Hairiness measurement of textile yarns using crossed polarizers	38
2.2.1	Hairiness	38

2.2.2	Experimental setup and theory	41
2.2.3	Results and discussion	43
2.2.4	Conclusion	46
2.3	Phase transition studies in Liquid Crystals using Laser Speckles . . .	46
2.3.1	Experimental setup and results	47
2.3.2	Conclusion	54
3	Optical Testing	55
3.1	Collimation testing utilizing optically active materials	55
3.1.1	Experimental setup and Theory	56
3.1.2	Results and Discussion	60
3.1.3	Conclusion	65
3.2	Study of refractive index of thin biconvex lenses using Michelson Interferometer	66
3.2.1	Experimental setup and theory	67
3.2.2	Focal length measurement	67
3.2.3	Radius of curvature measurement	70
3.2.4	Refractive index calculation	72
3.2.5	Error Analysis	72
3.2.6	Results and discussion	73
3.2.7	Conclusion	79
3.3	Testing of linear dichroic sheet polarizers with Michelson interferometer	79
3.3.1	Experimental setup and Theory	81
3.3.2	Results and Discussion	84
3.3.3	Error Analysis	92
3.3.4	Conclusion	93
3.4	Beamsplitter testing with Michelson Interferometer	93

3.4.1	Experimental Procedure and Theory	95
3.4.2	Results and Discussion	98
3.4.3	Beam ratio calculations	100
3.4.4	Conclusion	102
4	Conclusion and Future Scopes	103
A	Specifications of Ammonium Dihydrogen Phosphate	107
B	Sample MATLAB codes for simulation of diffusion	108
	Bibliography	111
	List of Publications	118