

## Table of Contents

### EYE DIAGRAMS & BIT ERROR RATES IN OPTICAL COMMUNICATIONS – BER(COM)

#### STUDENT MANUAL

1. INTRODUCTION.....	1
2. THEORY.....	2
2.1 <i>Threshold Detection and BER</i> .....	2
2.2 <i>BER, SNR, Sensitivity and Power Penalties</i> .....	5
2.3 <i>Eye Diagrams</i> .....	7
2.4 <i>Measurement and estimation of BER</i> .....	11
3. APPARATUS DESCRIPTION.....	12
4. LASER SAFETY.....	13
4.1 <i>Operational Hazard - Semiconductor Laser Diode</i> .....	13
5. OPERATING INSTRUCTIONS.....	14
5.1 <i>Before Switching On</i> .....	14
5.2 <i>Care of Optical Fibres</i> .....	14
5.3 <i>Operation of the PRBS to generate Eye Diagrams from ED-COM Transmission Links</i> .....	14
5.4 <i>Acquisition of Signal Variation Histograms, Noise Variance Q-factor and BER</i> .....	15
5.5 <i>Switching Off</i> .....	19
6. EXPERIMENTAL EXERCISES.....	20
6.1 <i>Eye Diagrams for the direct output of the PRBS generator</i> .....	20
6.2 <i>Eye Diagrams for transmission of the LED signal over a 1m patchcord</i> .....	20
6.3 <i>Investigation of the variation of fibre length for the LED transmitter – Risetime, 80% Pulse Width and Jitter</i> .....	20
6.4 <i>Investigation of the variation of fibre length for the LED transmitter – Noise, Q-factors and BER</i> .....	21
6.5 <i>Investigation of the eye diagrams for the laser transmitter</i> .....	21
6.6 <i>Investigation of Q-factor and BER as a function of increasing link length</i> .....	22
6.7 <i>Investigation of Q-factor and BER as a function of increasing bit rate</i> .....	22
APPENDIX A: PRBS Specification.....	23
A.1 <i>PRBS Specification</i> .....	23
APPENDIX B: FIBRE LINK LENGTH MEASUREMENT USING BER(COM).....	24
B.1 <i>Theory</i> .....	24
B.2 <i>Measurement of Fibre Length with BER(COM) – Method 1</i> .....	24
B.3 <i>Measurement of Fibre Length with BER(COM) – Method 2</i> .....	25
B.4 <i>Calculation of the Fibre Attenuation per km for the Optical Sources</i> .....	26
APPENDIX C: Result Table Templates.....	27
C.1 <i>Table Templates for Risetime, 80% Pulse Width and Jitter Results</i> .....	27
C.2 <i>Table Templates for Q-Factor and BER Results</i> .....	28
REFERENCES.....	29