Name	Matriculation Number	Date

Lab Partners	Group

Single Slit Diffraction

Part A: Single Slit Diffraction Pattern (Qualitative)

A-1 Describe what happens to the spatial width and overall brightness of the central peak as the slit width becomes narrower. Explain the observed trend qualitatively according to theoretical consideration.

A-2 The angular spread of the central peak $\Delta\theta$ can be approximated as $\Delta\theta \approx 2y/L$ radians. Determine the angular spread of the central peak $\Delta\theta$ for the slit width $a = 0.20$ mm. Compare your experimental value of the angular spread with the angular spread of the central peak calculated by using the formula $\Delta\theta \approx 2\lambda/a$.

Part B: Single Slit Diffraction Pattern (Quantitative)

$I_0 =$ _____				
Secondary Maxima	y_{left}	I_{left}	y_{right}	I_{right}
First				
Second				
Third				
Fourth				

Data Table 2

_____
Demonstrator's signature

B-1 Theoretical calculations from Equation (6) show that the angular locations and intensities of the secondary maxima are:

Secondary Maxima	Angular Position	Intensity
First	$\sin\theta_1 = 1.43030\lambda/a$	$I_1 = 0.047I_0$
Second	$\sin\theta_2 = 2.45902\lambda/a$	$I_2 = 0.016I_0$
Third	$\sin\theta_3 = 3.47089\lambda/a$	$I_3 = 0.008I_0$
Fourth	$\sin\theta_4 = 4.47741\lambda/a$	$I_4 = 0.005I_0$

Compare the angular location and intensity of the secondary maxima of your scan with the values in the table above. State the percentage discrepancy for each value.

m	y_{left}	y_{right}
1		
2		
3		
4		
5		

Data Table 3

Demonstrator's signature

B-2 For each minimium in your scan, determine the angular position $\sin\theta_m$.

B-3 Use an appropriate computer software, e.g., *Excel*, to perform a linear least squares fit to your data with the angular position of the minima $\sin\theta_m$ as the vertical axis and m as the horizontal axis. Plot a graph of angular position of the minima $\sin\theta_m$ against m. Also show on the graph the straight line that was obtained by the linear least squares fit to the data. Attached the graph to the report.

Gradient :

y-intercept :

B-4 The gradient of the plot $\sin\theta_m$ against m is λ/a. Determine the experimental value for the slit width a given that the wavelength of the laser is $\lambda = 650\,\text{nm}$. Compare it with the manufacturer-stated value and calculate the percentage discrepancy.

Experimental value:

Manufacturer-stated value:

% discrepancy:

Part C: Diffraction Pattern of A Human Hair

$L =$ _____		$d =$ _____
m	y_{left}	y_{right}
1		
2		
3		
4		
5		

Data Table 4

_____
Demonstrator's signature

C-1 Determine the angular position $\sin\theta_m$ of the minima of the scan and the thickness of the hair strand.

Analysis C-2 Estimate an experimental value for the thickness of your hair strand d and its associated uncertainty with the appropriate number of significant figures. Compare this value with the one determined in C-1.

Submission of Laboratory Report

Submit your full laboratory report including all the graphs within 24 hours after your laboratory session (except for Friday group - you will submit by the following working day (usually Monday) at 5 pm).

Important: Before leaving the laboratory, have a demonstrator sign on your data table(s)!