STUDENT CODE:					

Task	Summary Table	Mark (for marker's use only)	
A1			
D1			
D2			
D3			

A1

h	
θ	

D1

A	
B	
C	

D2

Order m	Grating constant a (meters)
1	
2	
3	
4	
5	
6	

D3

Mean of grating constant $\bar{a}$ (meters)	
Standard error of the mean $\sigma_{\bar{a}}$ (meters)	

Task	Summary Table	Mark (for marker's use only)	
E1			

x co-ordinates (cm)	y co-ordinates (cm)
-1.0	
-0.5	
0.0	
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	

E2	

$M(y, x, D, \theta)$	
I	
S	
ϕ^*	

F2			

b (meters)	

G1			

a^* (meters)	

Task	Answer	Marks (for marker's use only)
A1	Measure the height of the "zero-order spot" h, from the origin of the x-axis. Determine the incident angle θ of the laser beam from D and h. Write down the values of h in cm and θ in degrees to three significant figures in the corresponding table in the answer sheet.	**0.6**

Task	Answer	Marks (for marker's use only)
B1	Record the diffraction patterns on the graph paper for ϕ = 0°, 30°, 60° and 90° of the rotary disk and write down the corresponding angle of rotation ϕ next to each pattern. Write down "# 2" at the top of this graph paper. **PLEASE USE THE GRAPH PAPER PROVIDED FOR THIS TASK.**	**0.8**

Task	Answer	Marks (for marker's use only)
C1	Mark the centers of the diffraction spots from Sample 3 for ϕ = 0°, 30°, 60° and 90° on the graph paper and write down the corresponding angle of rotation ϕ next to each pattern. Write down "# 3" at the top of this graph paper. **PLEASE USE THE GRAPH PAPER PROVIDED FOR THIS TASK.**	**0.8**

Task	Answer	Marks (for marker's use only)
D1	Equation (3) can be rearranged to obtain a quadratic equation for the grating constant a of Sample 3, as $$Aa^2 + Ba + C = 0. \quad (4)$$ Derive the expressions for A, B and C. Enter your results in the corresponding table in the answer sheet.	**0.9**

Task	Answer	Marks (for marker's use only)
D2	By solving this quadratic equation and using the measured y values of the diffraction spots for Sample 3 at $\phi = 90^{\circ}$ (See Task C1), together with the known values of D, θ and λ, determine the grating constant a of Sample 3 in meters to three significant figures for each diffraction order from the 1st order ($m = 1$) up to the 6th order ($m = 6$) [*Hints: These orders correspond to the six spots above the zero-order spot*]. Enter your results in the corresponding table in the answer sheet.	**1.6**

Task	Answer	Marks (for marker's use only)
D2 Cont.		

Task	Answer	Marks (for marker's use only)
D3	Calculate the mean for the grating constant a in meters to three significant figures and the standard error of the mean. Enter your results in the corresponding table in the answer sheet.	**0.8**

Task	Answer	Marks (for marker's use only)
E1	Along the continuous diffracted curve of Sample 4 projected on the graph paper, measure the y-coordinates in cm for ten points starting from x = - 1.0 cm to 3.5 cm with a step of 0.5 cm. Enter your results in the corresponding table in the answer sheet. **PLEASE PLACE YOUR RESULTS IN THE SUMMARY TABLE FOR THIS TASK.**	**0.6**

Task	Answer	Marks (for marker's use only)
E2	Based on Eq. (1) given in Task D, construct a linear equation in the form of $$M(y, x, D, \theta) = I(D) + S(\phi^*)x \, . \quad (5)$$ Determine the functional forms for $M(y, x, D, \theta)$, $I(D)$ and $S(\phi^*)$. Plot M against x, using the data recorded in Task (E1). Determine the unknown angle ϕ^* in degrees from this graph. Write down all the functional forms and the value of ϕ^* in the corresponding table in the answer sheet.	**1.6**

Task	Answer	Marks (for marker's use only)
E2 Cont.		

Task	Answer	Marks (for marker's use only)
E2 Cont.		

Task	Answer	Marks (for marker's use only)
F1	Record the diffraction patterns you observed for ϕ = 0°, 30°, 60° and 90° on separate graph papers for each value of ϕ. At the top of each graph paper, put down '#5' and the corresponding ϕ value. It is expected that you could observe more than 10 diffraction orders. However, you are required to record only three relatively brighter orders on each graph paper. **PLEASE USE THE GRAPH PAPERS PROVIDED FOR THIS TASK.**	**0.8**

Task	Answer	Marks (for marker's use only)
F2	With this understanding, estimate the spacing b in meters of the uniformly spaced pre-made grooves of Sample 5 using the recorded diffraction pattern for $\phi = 0^{\circ}$ from Task F1. Enter the value of b in the answer sheet. [*Note that in estimating the value of b, you are only required to take the measured data of the first diffraction order and the estimated b should be rounded up to three significant figures.*]	**1.6**

Task	Answer	Marks (for marker's use only)
F2 Cont.		

Task	Answer	Marks (for marker's use only)
G1	For the ZnSe sample, based on Figure 16 and the experimental conditions given above, determine the lattice-plane spacing a^* of the periodic atomic lattice planes that are perpendicular to the nano-grooves with non-uniform spacing, in meters. Enter your result in the corresponding table in the answer sheet.	1.7

Task	Answer	Marks (for marker's use only)
G1 Cont.		